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RAILWAY
MECHANICAL ENGINEER

New Haven Buys 103 Coaches

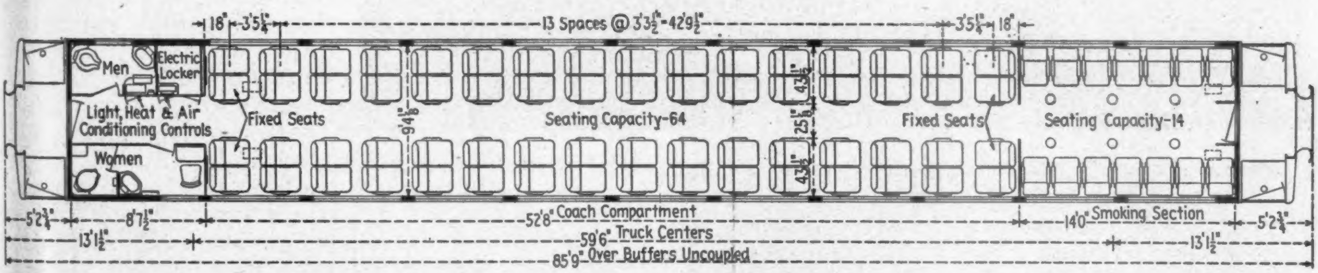
Five years of research work culminated in the development of a basic design which has now been adapted to several types of post-war cars

FIVE YEARS AGO the New York, New Haven & Hartford began the research and development work that has culminated in a postwar passenger-car program involving 207 cars and an expenditure of approximately 20 million dollars. A substantial part of the program has been completed by the delivery of 103 coaches from the Worcester, Mass., plant of the Pullman-Standard Car Manufacturing Company. The orders include sleeping, dining and parlor cars.

The details of these new cars were worked out in the construction of a wooden demonstrator car which included all the design features developed through the years 1943 to 1946. Minor improvements were made in the interior arrangement of this experimental car at the company shops at Readville, Mass., which resulted in the specifications for the nine car types, all of which have one fundamental design of car body construction, the interior floor plans being varied to suit the requirements of the passenger traffic department. The basic design of body construction involves the use of low-alloy high-strength steel welded throughout to form a single structural unit.

The car body design exceeds in strength the Association of American Railroads requirements for high-speed service and will permit joint operation with the Pennsylvania between Boston, Mass., and Washington, D. C. The roofs are reinforced with girder type construction to resist collapse in event of derailment and the strength of the end frame has been increased to provide additional anti-telescoping resistance.

The new cars are equipped with an entirely new truck design which has resulted in improved riding qualities. This truck, equipped with high-speed brakes, was tried out on existing coach and dining car equipment for 15 months of continuous experimental service before being



Floor plan of the coaches

built into the new coaches. Other design features are additional insulation, two-aspect electric marker lamps, public-address system, panoramic breather-type side windows, fluorescent lighting, air conditioning, mechanical water cooler, pneumatic door openers and closers, and tight-lock couplers.

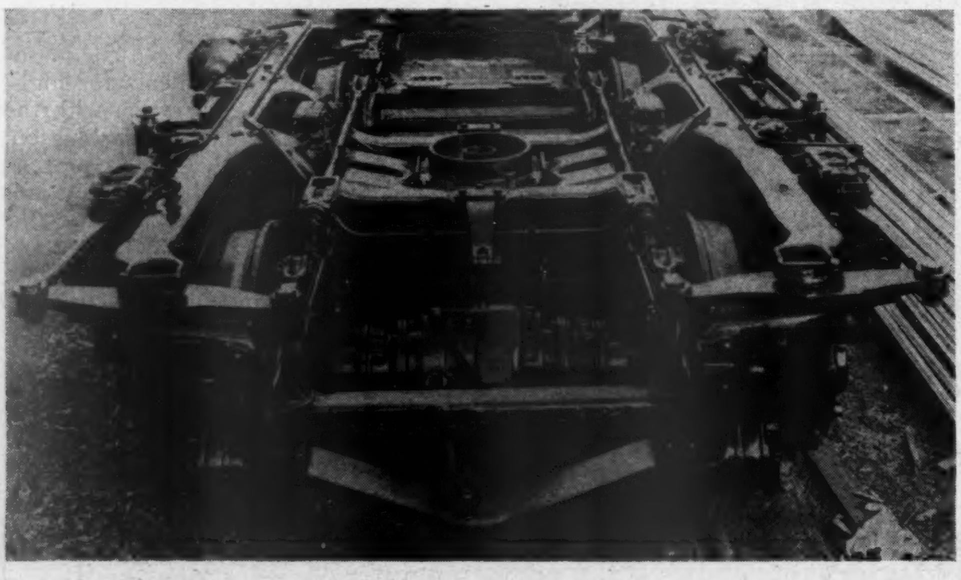
The overall length of the new coaches is 85 ft. 9 in. over buffers uncoupled, with an extreme width of 10 ft. 1 in. over the stainless-steel side sheathing and a maximum height of 13 ft. 4 in. The coaches will negotiate a 250-ft. radius curve and weigh approximately 125,000 lb. General dimensions are shown in a table.

Body Construction

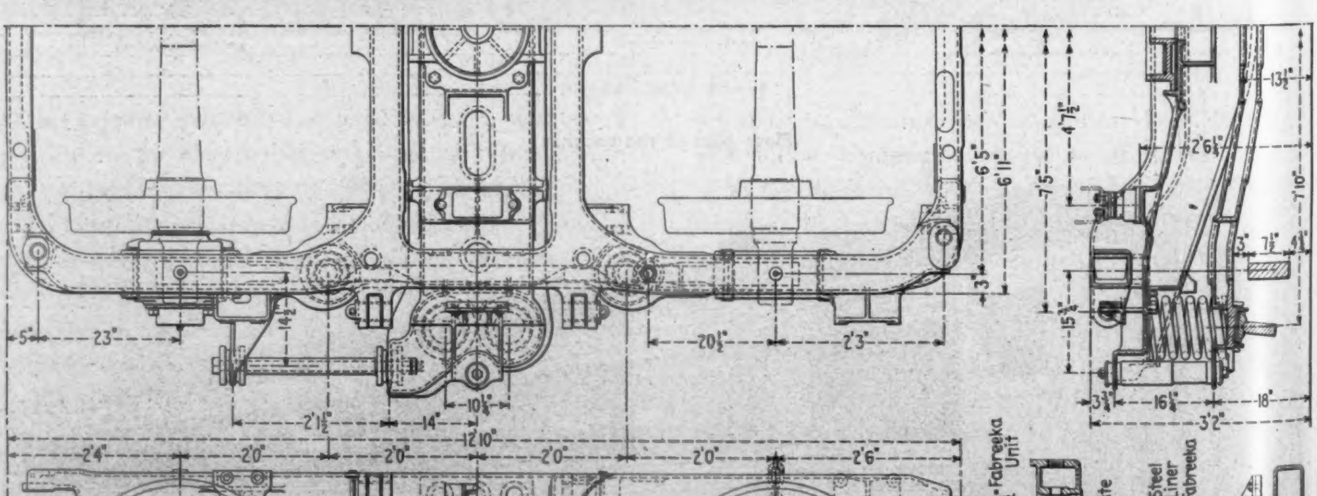
The car body is designed to withstand a compression load of 900,000 lb. at line of draft with a maximum of 0.8-in. deflection measured at the center of the car. The underframe is of welded high-strength low-alloy steel having center sills consisting of two A.A.R. Z-26 sections weighing 31.3 lb. per ft. with top flanges continuously welded. The draft sills are of welded construction. The side sills, 12-1/16-in. deep, are of 0.135-in. thick Yoder-section L shape, with outside side sills of 2½-in. by 1½-in. by ⅛-in. angle. Cross members are welded to these sills. The bolsters are weldments of the single-web type. The cross bearers, spaced approximately 8 ft. 6 in., are pressed sections. The floor cross beams are 3-in. Z bars. Jacking pads are welded to the underframe at the four corners of the car.

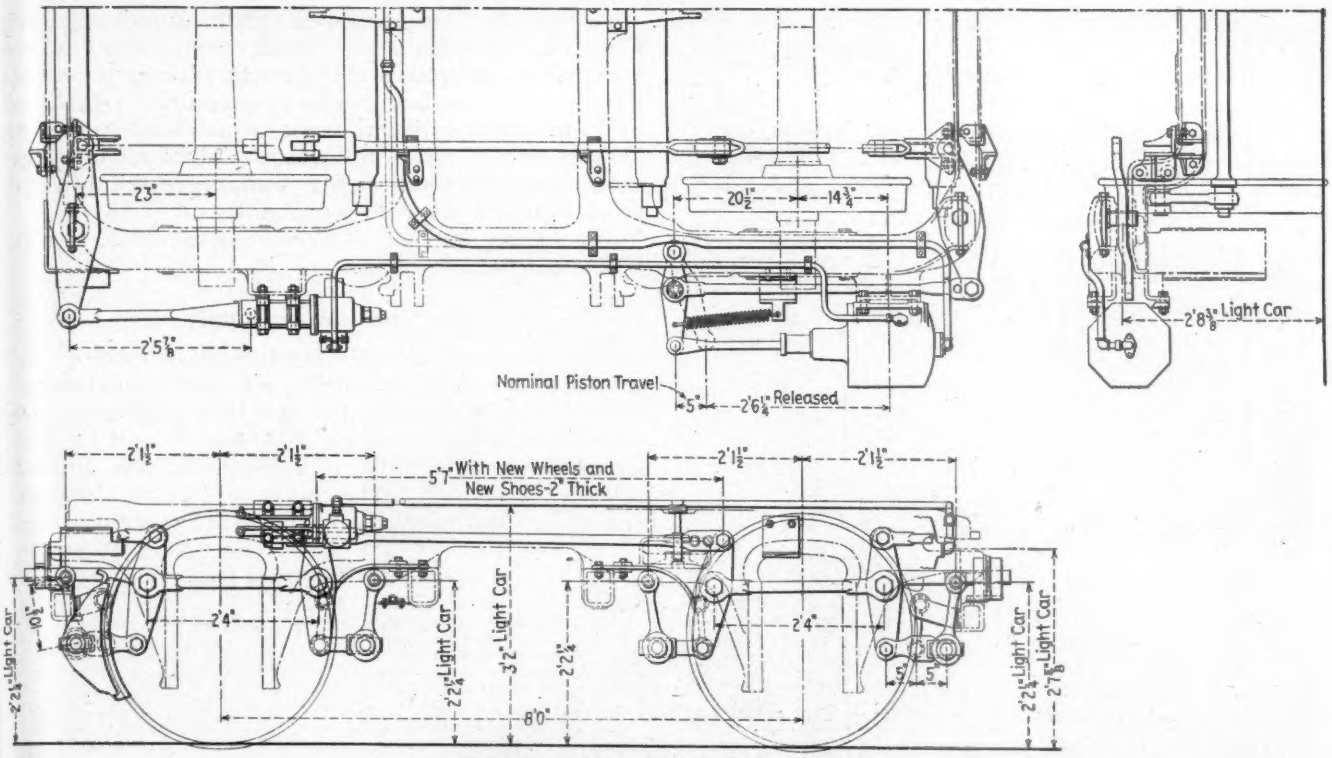
The floor stringers are low-alloy steel to which poplar furrings are attached. The floor is 3 S ½ H arched aluminum laid crosswise and screwed to the underframe. Above this is Tucolith composition laid 13/16 in. thick. Over the composition flooring is a cork slab subfloor 5/16 in. thick, while the surface is 3/16-in. rubber tile, silver gray in the aisles and black-white elsewhere.

The side frames are jig-welded of girder-type construction with 2½ in. by 1½-in. by ⅛-in. outside sill angles and Z-bar belt rails and window headers. The side sheets, spot welded to the frame, are .075 in. thick with stainless fluted molding above and below windows. A fluted stainless-steel skirt is used below side sills.



(Left) The truck showing the generator drive; (below) Details of the truck





The arrangement of the brake equipment

The roof is turtle-back construction of high tensile low-alloy steel, continuous between end hoods. The sides, roof, floor and ends of the cars are insulated.

The car interiors are finished below the windows with 3/16-in. tempered Presdwood with pier panels of anodized aluminum. Bulkheads are covered with a sheet of anodized aluminum above wainscot line. The headlining, ceiling and ends are aluminum sheet .060 in. thick. The heater grills are copper-bearing steel. Window cappings are black Micarta.

All coaches have a smoking section. The main section, seating 64, is separated from the 14-passenger smoking section by a ¾-in. glass partition with glass windbreakers at end doors of the smoking section.

The large side windows provide visibility for passengers in two seats and are glazed with ¼-in. Solex plate glass outside and ¼-in. safety plate inside. The glazed sealed units are set in extruded rubber.

All interior hardware is satin-finish chrome plate. Luggage racks have cast aluminum supports with extruded square aluminum rods.

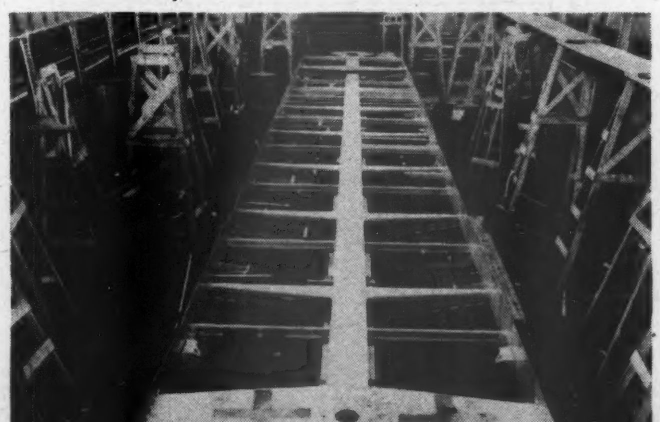
Seats and Interior Finish

There are 28 rotating and reclining seats and four bulkhead seats in the main passenger section, all fitted with Airfoam cushions and soft spring and padded backs upholstered in blue mohair fabric with Bakelite arm caps. The smoking-section chairs are upholstered in tan pigskin. The window curtains are Pantasote Hunter green. Bone-gray enamel is used on headlining and side walls. Slate-gray enamel is used for the finish from window sills to floor. The curtain box molding is striped in red and the inside of the end door at the saloon end of the car is finished in red and the opposite door is finished in blue enamel. The hallway is finished in aluminum enamel.

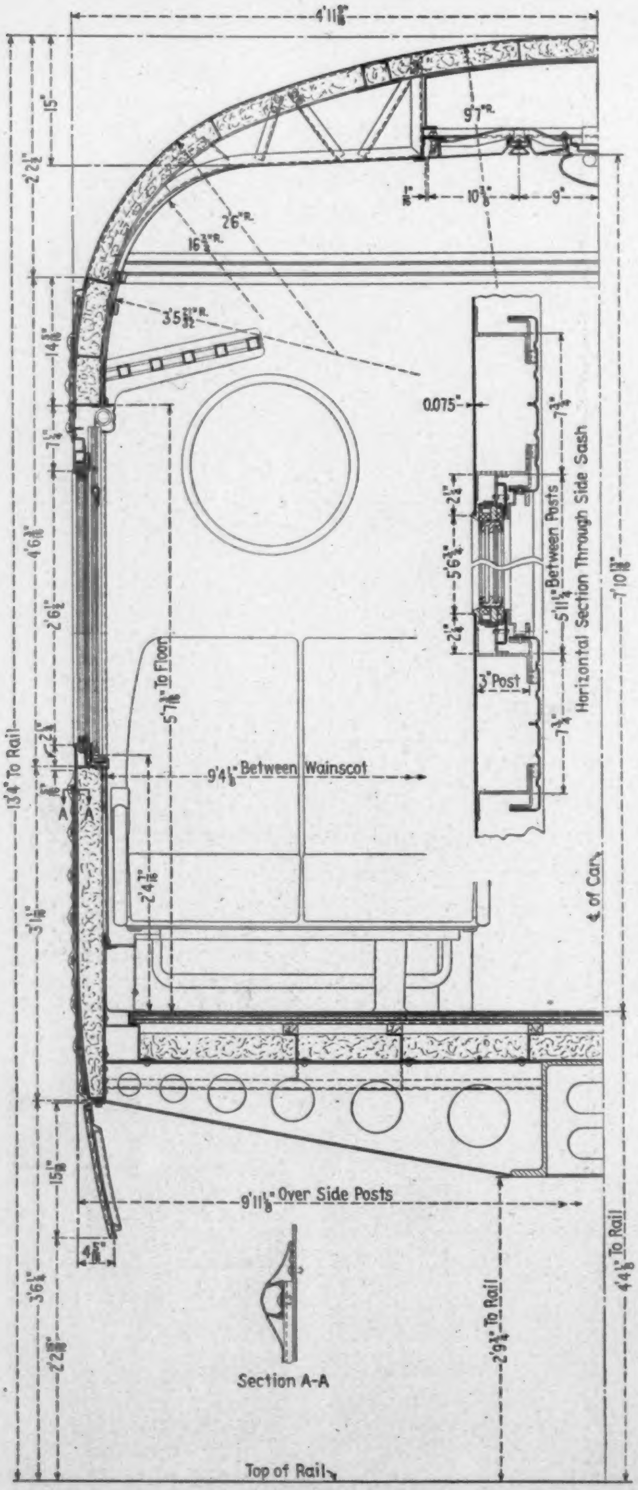
The cars are heated by overhead heat in connection with the air conditioning system and also at the floor level. Fin-type tubes with loop equipment is used at the floor level and thermostatic regulation for both systems is installed.

Trucks and Brake Equipment

All of the new passenger cars are equipped with an entirely new passenger-car truck, developed through the combined efforts of the railroad's engineering staff and the General Steel Castings Corporation. This truck is known as the outside-swing-hanger type and departs from the conventional truck design in that the car body weight is supported directly on coil springs suspended



Detail of the underframe



Typical cross-section

from the *outside* of the truck frame rather than from the *inside* as in conventional type trucks.

This arrangement of spring suspension provides a greater lateral stability of the car body in operating at high speeds around curves than results with conventional design trucks. As an experiment, the New Haven equipped one of its early streamline coaches in 1945 with a truck of this design. The car was placed in service in September of that year, and has been in continuous use since. The riding qualities of this truck were such an improvement over the conventional type that after a period of approximately 15 months of experimental continuous service, it was decided to utilize it on all the new equipment.

The trucks are equipped with American Steel Foundries' Simplex unit-cylinder clasp brakes which are designed to produce 250 per cent braking ratio with 100 lb. per sq. in. brake-cylinder pressure. Two 12-in. by 10-in. brake cylinders are used in conjunction with the clasp brake and A.S.F. manual slack adjusters are incorporated in the designs. Fafnir grease-lubricated roller bearings are used on all axles.

The brake schedule is Westinghouse D-22-P with D-22 AR control valves.

Electric Power Supply

Electric power for air conditioning, lighting and auxiliary services is supplied by a body-mounted motor-generator, driven from a car axle by a gear and clutch drive. The set consists of a 25-30-kw., 76-volt d.c. generator, directly connected to a 25-hp. 220-volt, 3-phase, 60-cycle a.c. motor. The motor is used to drive the generator when the car is connected to standby power.

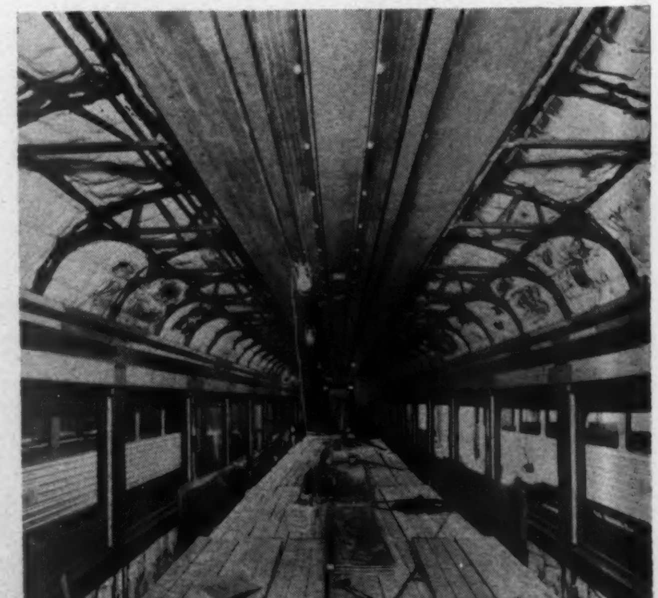
Connected Electrical Load

		Watts
Regulated d.c. circuits		
15	15-watt emergency lights	225
4	40-watt vestibule lights	160
2	30-watt marker lights	60
1	evaporator blower motor	1,030
4	ventilating fans	200
Unregulated d.c. circuits		
2	25-watt locker lights	50
2	door operators	35
1	condenser fan motor	800
1	motor alternator	2,040
	Total	14,200

There are two 60-amp. 4-pole receptacles for receiving standby power and two 150-amp. battery-charging receptacles on each car.

The battery is a 64-volt, 32-cell, lead-acid type, rated 600 amp.-hr. at the 8-hour discharge rate. Each battery is made up of ten 3-cell trays and two 1-cell trays. A 1.2-kw. motor-alternator receives power from the 64-volt d.c. power source and delivers 110-volt a.c. power for fluorescent lighting, water cooler, and public-address system.

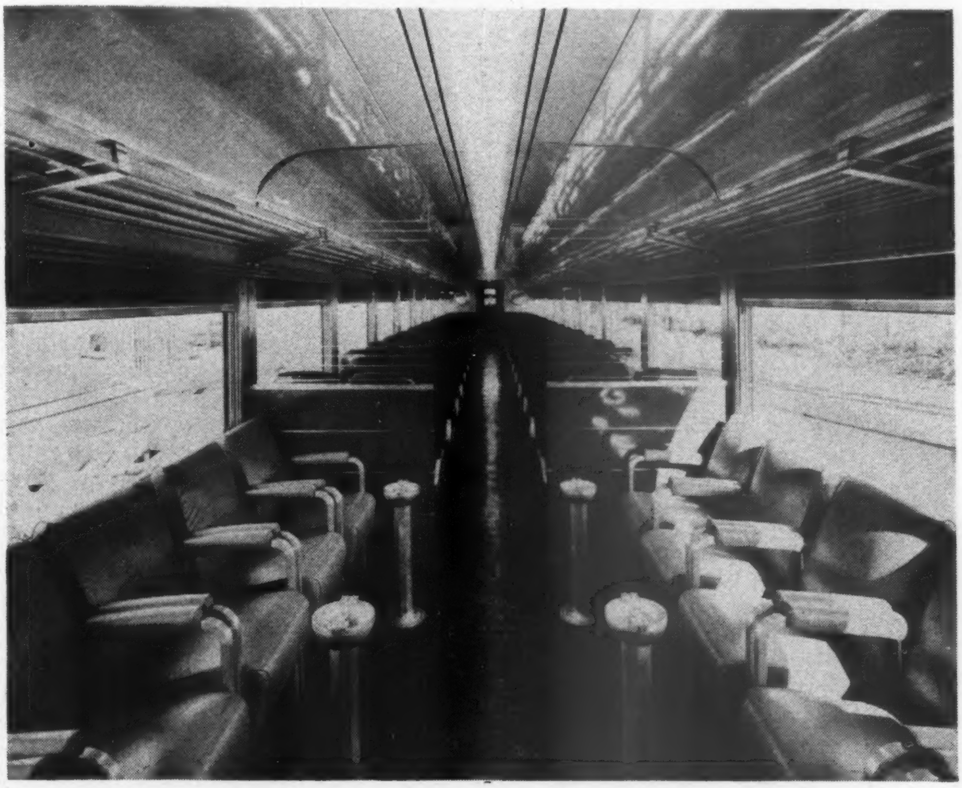
The electric locker includes the generator control



Roof structure and insulation

panel, generator regulating relay panel, lamp regulator, a.c. line contactor, a.c. line relay amplifier for the public-address system, compressor starting panel, automatic reset relay, and floor-heat control panel. All wires and cables are flexible and have rubber insulation with weatherproof braid. Conduits throughout are aluminum. Under the car, they are of iron-pipe size, and elsewhere they are electric tubing (thinwall) with aluminum fittings throughout.

General illumination in the body of the coaches is supplied by trough-type fluorescent fixtures, making a continuous line of light along the center line of the car ceiling. The lamps used are 48-in., T-12, 40-watt, 120-volt a.c., 3,500 deg. white, hot-cathode fluorescent



The smoking section at the end of the car

Partial List of Materials and Equipment on the New York, New Haven & Hartford Streamline Coaches

Axles ... Bethlehem Steel Co., Bethlehem, Pa., Carnegie-Illinois Steel Co., Pittsburgh, Pa.
Bearings, journal ... Fafnir Bearing Co. New Britain, Conn.
Bearings, side, truck ... Symington-Gould Corp., Rochester N.Y.
Brakes, air ... Westinghouse Air Brake Co., Wilmerding, Pa.
Brakes, clasp ... American Steel Foundries, Chicago
Couplers and yokes ... American Steel Foundries, Chicago; Buckeye Steel Castings Co., Columbus, Ohio; McConway & Torley Corp., Pittsburgh, Pa.; National Malleable & Steel Castings Co., Cleveland, Ohio; Symington-Gould Corp., Rochester, N.Y.
Draft gear, rubber mat type ... Waugh Equipment Co., New York
Metallic steam connections ... Barco Mfg. Co., Chicago
Center pin assemblies, bolster locking ... W. H. Miner, Inc., Chicago
Shock absorbers ... Monroe Auto Equipment, Monroe, Mich.
Springs, truck ... American Locomotive Co., Schenectady, N.Y.
Trucks ... General Steel Castings Corp., Eddystone, Pa.
Signal equipment, air ... Westinghouse Air Brake Co., Wilmerding, Pa.
Wheels ... Bethlehem Steel Co., Bethlehem, Pa.; Carnegie-Illinois Steel Corp., Pittsburgh, Pa.; Standard Steel Works Div., Baldwin Locomotive Works, Burnham, Pa.
Batteries ... Electric Storage Battery Co., Philadelphia, Pa.
Charging receptacles, battery ... A. & J. Anderson Mfg. Co., Boston, Mass.
Receptacles, a.c., standby ... Pyle-National Co., Chicago
Generator drive ... Spicer Mfg. Co., Toledo, Ohio
Motor-generator equipment ... General Electric Co., Schenectady, N.Y.
Terminal boards for m.-g. equipment ... Safety Car Heating & Lighting Co., New York
Motor alternators ... Safety Car Heating & Lighting Co., New York
Switch panels ... Safety Car Heating & Lighting Co., New York
Heating equipment ... Vapor Car Heating Co., Chicago
Clamp for steam pipe ... Illinois Railway Equipment Co., Chicage
Air conditioning ... Frigidaire Division, General Motors Corp., Dayton, Ohio.
Air distributors ... Safety Car Heating & Lighting Co., New York
Fans, exhaust ... Safety Car Heating & Lighting Co., New York
Filters ... Air Devices, Inc., New York; Farr Co., Los Angeles, Calif.
Registers and grills ... Barber-Colman Co., Rockford, Ill.
Insulation, car (stonefelt) ... Johns-Manville Sales Corp., New York
Insulation, sound deadener ... J. W. Mortell Co., Kankakee, Ill.
Insulating units, truck and body side bearings ... Fabreeka Products Co., Boston, Mass.
Paint materials:
Exterior sides and vestibules ... E. I. du Pont de Nemours & Co., Wilmington, Del.
Roof ... Patterson-Sargent Co., Cleveland, Ohio
Interior ... Pittsburgh Plate Glass Co., Pittsburgh, Pa.; Sherwin-Williams Co., Cleveland, Ohio
Public address system ... DeMambro Radio Supply Co., Cambridge, Mass.
Odor absorbers, Dorex ... Tuco Products Co., New York
Chairs, smoking compartment ... General Fireproofing Co., Youngstown, Ohio
Seats, passenger ... Heywood-Wakefield Co., Gardner, Mass.
Upholstery:
Seats, passenger ... Goodall Fabrics, Inc., New York; Sidney Blumenthal Co., Inc., Shelton, Conn.; Massachusetts Mohair Plush Co., Boston, Mass.
Seats, smoking compartment ... Goodall Fabrics, Inc., New York
Baggage racks ... Rostand Manufacturing Co., Milford, Conn.
Smoking stands ... Rostand Manufacturing Co., Milford, Conn.
Guards, window ... Rostand Manufacturing Co., Milford, Conn.
Capping, window ... Westinghouse Electric Corp., Micarta Div., Trafford, Pa.
Sash ... Adams & Westlake Co., Elkhart, Ind.
Glass, window:
Outside ... Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Inside and outside ... Libbey-Owens-Ford Glass Co., Toledo, Ohio; Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Curtains, window and fixtures ... Adams & Westlake Co., Elkhart, Ind.
Curtain material:
Pantasote ... Pantasote Co., New York
Silk facing ... Goodall Fabrics, Inc., New York
Lamp regulators ... Safety Car Heating & Lighting Co., New York
Lighting fixtures ... Safety Car Heating & Lighting Co., New York
Lights, marker ... Lovell-Dressel Co., Arlington, N.J.
Covering, floor, rubber tile ... Hood Rubber Co., Watertown, Mass.
Door closers ... National Pneumatic Co., Rahway, N.J.
Doors, trap ... O. M. Edwards Co., Syracuse, N.Y.
Doors ... Pullman-Standard Car Mfg. Co., Chicago
Curtain, vestibule ... Adams & Westlake Co., Elkhart, Ind.; Morton Manufacturing Co., Chicago
Diaphragms, vestibule ... Morton Manufacturing Co., Chicago
Cabinets:
Toilet paper ... Griffith-Hope Co., West Allis, Wis.
Paper towel ... Griffith-Hope Co., West Allis, Wis.
Hoppers ... Dayton Manufacturing Co., Dayton, Ohio
Hopper seats ... Crane Co., Chicago
Lavatory, china ... Crane Co., Chicago
Deodorant (for salons) ... Rochester Germicide Co., Rochester, N.Y.
Chairs, vanity ... Coach & Car Equipment Co., Chicago
Table, vanity ... Wood Plastics Co., Cambridge, Mass.
Containers, drinking cup ... Logan Drinking Cup Div., U. S. Envelope Co., Worcester, Mass.
Water coolers ... Westinghouse Electric Corp., East Pittsburgh, Pa.
Smoking signs, aluminum ... Etched Products Corp., Long Island City, N.Y.
Mirrors ... Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Mirror frames:
Round ... Rostand Manufacturing Co., Milford, Conn.
Rectangular ... Adams & Westlake Co., Elkhart, Ind.

lamps arranged for instant starting. Illumination on the reading plane ranges from 15 to 20 footcandles.

There are also nine emergency lights within the main fixtures. These are 15-watt, 40-60-volt, T-6 incandescent lamps. The fluorescent lamps are supplied by the motor-alternator and the incandescent lamps directly from the regulated d.c. power source. Forty-watt,

Vestibule end of the car

60-volt incandescent lamps are used in the vestibules and 25-watt, 60-volt lamps in the electric and air-conditioning control lockers.

Permanent built-in two-aspect electric marker lights are installed in all four corners of the car. These are fitted with 30-watt 60-volt double-contact-base incandescent lamps.

The coaches are all equipped with electro-mechanical air conditioning having a capacity of 8 tons. The air in the car is kept clean and odorless by means of lint protectors, metallic filters and activated-carbon air-purifier units. The air-conditioning system changes the air in the car 1½ times per minute when in operation, and it has adequate capacity for precooling of cars at terminals before departure. It will maintain an inside temperature of 82 deg. dry bulb with a full passenger load of 78 people, when the outside temperature is 100 deg. dry bulb, and 78 deg. wet bulb. Air is circulated at the rate of 2,400 cu. ft. per min. with 25 per cent of make-up fresh air.

Compressor and condenser units are located under the car. The evaporators are of the split type, having d.c. motor-driven blowers, and are located overhead between saloons. The compressor operates at approximately half-speed when a reduced section of the evaporater is in use. The condensers have a water spray system with water storage and air pressure tanks under the car. Sprays are controlled by compressor head pressure.

The recirculating-air grill is located in the end of the car in the passage-way ceiling, with fresh-air intake through the vestibule ceiling. The metal air filters (two per car) which pass both fresh and recirculated air are located between the recirculating grill and the blowers.

General Dimensions and Weight of New Haven Streamline Coaches

Length over platforms (buffers), ft. in.	85- 3
Truck centers, ft. in.	59- 6
Width over side posts, ft. in.	9-11-1/8
Width between side posts, ft. in.	9- 5-1/8
Height, rail to top of carlines, ft. in.	13- 4
Height, rail to top of platform plate, ft. in.	4- 2-11/16
Height, rail to center of coupler, ft. in.	2-10-1/2
Width of vestibule platform, ft. in.	4- 8
Seating capacity	78
Light weight of car, lb.	125,000

Two activated-carbon air purifying units are located in the framing above the recirculating air grill. There is also a lint screen above the grill. All filters and grills are easily removable for cleaning or replacement. There are two, 200 c.f.m., 9-in. exhaust fans, located at the smoking-lounge end of the car. Also two 50 c.f.m. exhaust fans, one for the electric locker and men's saloon, and the other for the powder room in the women's saloon. There are also two 50 c.f.m. static exhaust ventilators in the passenger compartment.

Conditioned air is delivered into the car by a delivery duct extending the full length of the main compartment. This duct has adjustable slides and there are hinged panels at each side to permit cleaning of the duct.

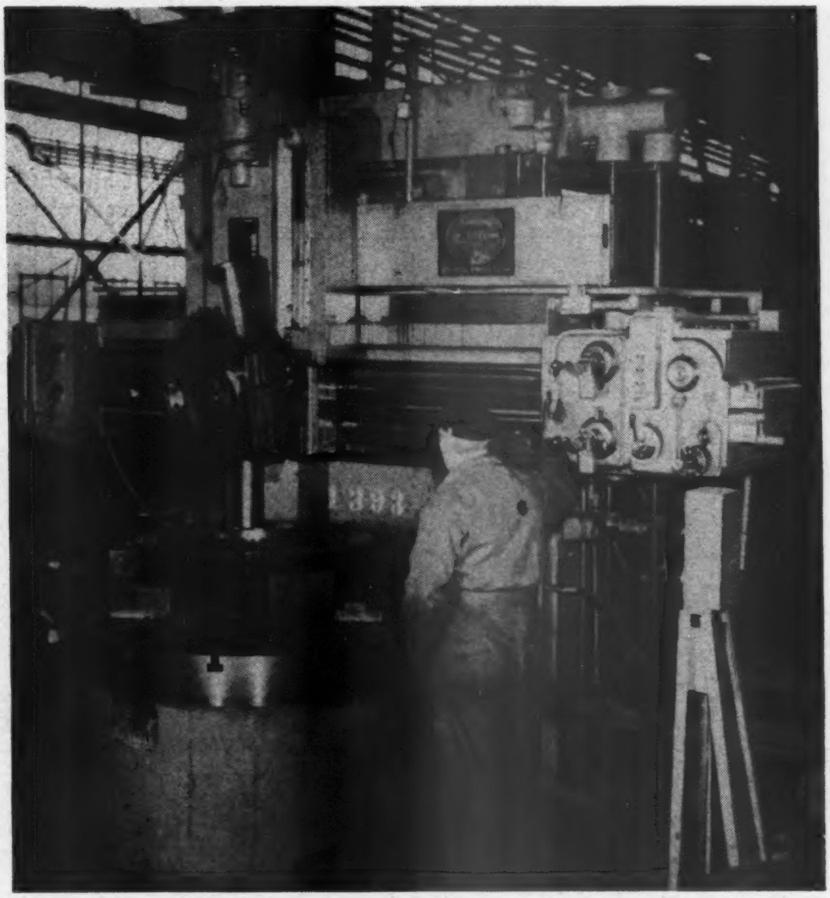
Side-wall heating is supplied by 1⅜ in. copper-fin radiation with loop equipment and thermostatic control. Overhead heating is also used with controls which operate with the side-wall heating controls.

Heat controls insure proper inside temperatures with any outside temperature. Even in the event of failure of the heating control, heat is supplied to the car all of the time it is on steam.

A public address system is available for communication and announcements in individual cars or in all cars throughout the train. There is one microphone in each car in the passageway in a small wall cabinet. There are two speakers in the air duct, one near each end of the passenger space. A switch at the microphone permits talking to the individual car or to the entire train. Electro-pneumatic door operators open doors by a passenger's touch, from either the outside or the inside of the car and close the door automatically. An electric drinking water cooler operates at 110 volts, a.c.

One of four 35,000-lb. screws which was turned recently at The Baldwin Locomotive Works—It is an adjustable, tensional member in one of two vertical 5,000,000-lb. universal testing machines, the largest in size and capacity yet produced in the United States for testing in tension, compression and flexure

Automatic Wheel Machining



Boston & Maine utilizes a 54-inch Bullard Man-Au-Trol* for machining three sizes of Diesel locomotive wheels at three times the former output

DIESEL-electric locomotives, whether in passenger, freight or switching service, are, of necessity, kept in service so many more miles or hours in a given period than has been the case with steam power that the problem of maintaining an adequate supply of steel wheels to protect the service has become one of no mean proportions. In addition to a demand for a greater number of wheels the requirements as to machined surfaces, because of the design of traction motor trucks, has made it necessary radically to revise practices with respect to the machining of wheels and to explore new fields in the matter of machine tools and tooling equipment.

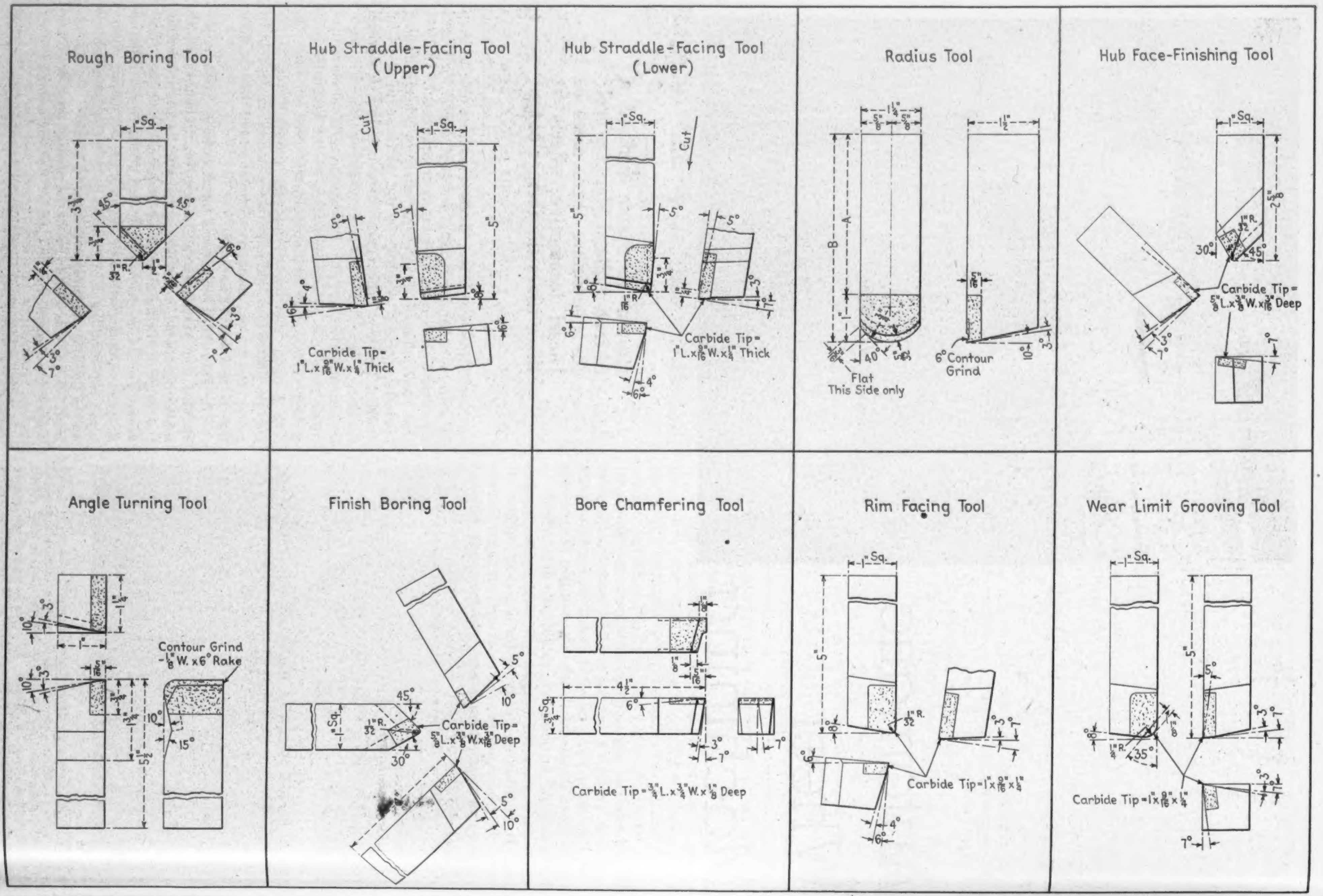
The Boston & Maine, which, for example, operated road Diesel power for a total of 4,529,683 locomotive miles and switching Diesels for a total of 239,144 hours during the year 1946, found that even with the most modern manually controlled wheel boring equipment in its North Billerica, Mass., shops it was not able to keep up with the mounting demand for steel wheels for Diesel locomotives, rail cars and passenger equipment. In 1945 that road initiated an intensive study of wheel finishing operations which resulted in the purchase of a 54-in. Bullard Man-Au-Trol vertical turret lathe for steel-wheel finishing. This machine was installed and placed in regular operation late in 1947. It is able to turn out more than three times the maximum output of the manually controlled vertical turret lathe formerly used on this job. The average time of 64 minutes shown Table III is routine production, although the machine is capable of going through the automatic cycle in a total floor-to-floor time of less than 50 minutes.

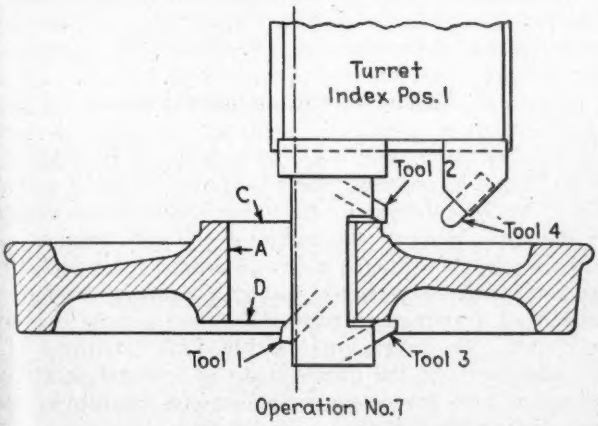
The Man-Au-Trol vertical turret lathe is basically the Bullard Cut Master having a control mechanism which makes it possible to perform automatically any job within the range of the machine which requires 39, or less, functions. The 54-in. machine installed at the North Billerica shops is equipped with special chucking and tooling equipment for handling 33-in., 36-in. and 40-in. steel wheels and is the first machine of its type to be used in a railroad shop. While it is kept busy, at the present time, on Diesel wheels the machine can be used for the machining of other

Table I—Former Method of Machining 40-in. Diesel Locomotive Wheels on Bullard 54-in. Vertical Turret Lathe Turret Lathe

Operation	Main head	Side head	Tools Used
First chucking:			
1. Face rim	....	x	Carbide
2. Rough bore	x	....	Carbide
3. Finish bore	x	....	High speed
4. Rough face hub	x	....	Carbide
5. Finish face hub	x	....	High speed
6. Rough turn outside diameter of hub	x	....	High speed
7. Finish turn outside diameter of hub	x	....	High speed
8. Chamfer radius on bore	x	....	High speed
Second chucking (wheel turned over):			
1. Rough face hub	x	....	Carbide
2. Finish face hub	x	....	Carbide
3. Rough turn hub	x	....	High speed
4. Finish turn hub	x	....	High speed
5. Turn 20-deg. angle	x	....	High speed
6. Turn 45-deg. angle	x	....	High speed
Total time required:			
Floor-to-floor (machining and handling time)—4 hours			

*A complete description of the machine appeared in the *Railway Mechanical Engineer* for December, 1945, page 615.


Rough Boring Tool
Hub Straddle-Facing Tool (Upper)
Carbide Tip = 1" L. x 9/16" W. x 1/4" Thick
Hub Straddle-Facing Tool (Lower)
Carbide Tip = 1" L. x 9/16" W. x 1/4" Thick
Radius Tool
Flat This Side only
6° Contour Grind
Hub Face-Finishing Tool
Carbide Tip = 5/8" L. x 3/8" W. x 3/16" Deep
Angle Turning Tool
Contour Grind - 1/8" W. x 6° Rake
Finish Boring Tool
Carbide Tip = 5/8" L. x 3/8" W. x 3/16" Deep
Bore Chamfering Tool
Carbide Tip = 3/4" L. x 3/4" W. x 1/8" Deep
Rim Facing Tool
Carbide Tip = 1" x 9/16" x 1/4"
Wear Limit Grooving Tool
Carbide Tip = 1" x 9/16" x 1/4"



Operation No.7

In turret index Position 1 the rough boring is performed and the tool set-up shown in the drawing faces the hubs

Table II—Carbide Tool Performance on Bullard Man-Au-Trol

Tool No.	Purpose of Tool	No. wheels per Tool Grind
1	Rough boring	8
2	Straddle facing (hub)	10
3	Straddle facing (hub)	10
4	¼-in. radius, roughing[1]	6
5	Semi-finish boring	10
6	Hub facing-finishing	12
7	20-deg. angle undercut	8
8	Finish boring	4
9	¼-in. radius, roughing[1]	10
10	Chamfering	15
11	Rim facing	3
12	Cutting wear limit groove	7

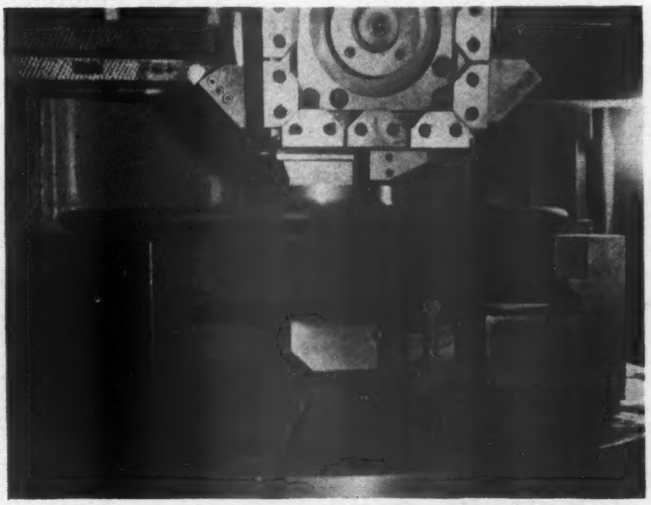
[1]Tools No. 4 and 9 are identical in design

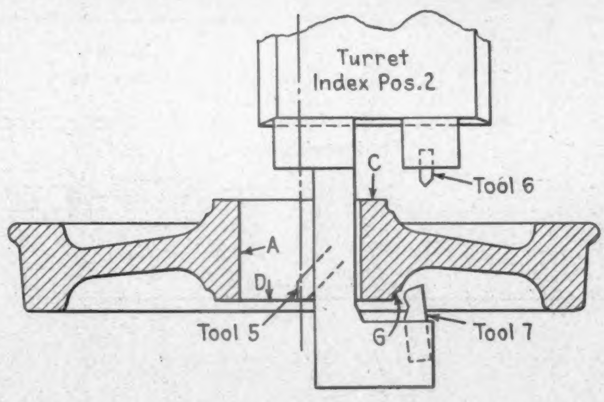
On the opposite page are shown the tools that are used on the automatic wheel machining job. They are all carbide tools. There are eight tools shown in the drawing and the other four, the function of which is shown in the table above, are identical in design to tools illustrated

parts required by the railroad and can be used either as an automatic machine or operated by manual controls.

An interesting feature of the machine is that its automatic functions are pre-established by securing function dogs on the control drum in operation sequence, then manually bringing the tools through each respective cut. At the completion of each cut a setting is made on the Man-Au-Trol Detector for that operation. When all the operations have been completed and all of the function stops set, the machine is then thrown into automatic operation and becomes 100 per cent automatic. Should it be desired to machine an odd part of another design, for any reason, the machine may be thrown out of automatic control, the piece machined manually and then production again continued on the part for which the automatic functions previously had been set, without any further adjustments other than setting the original tooling.

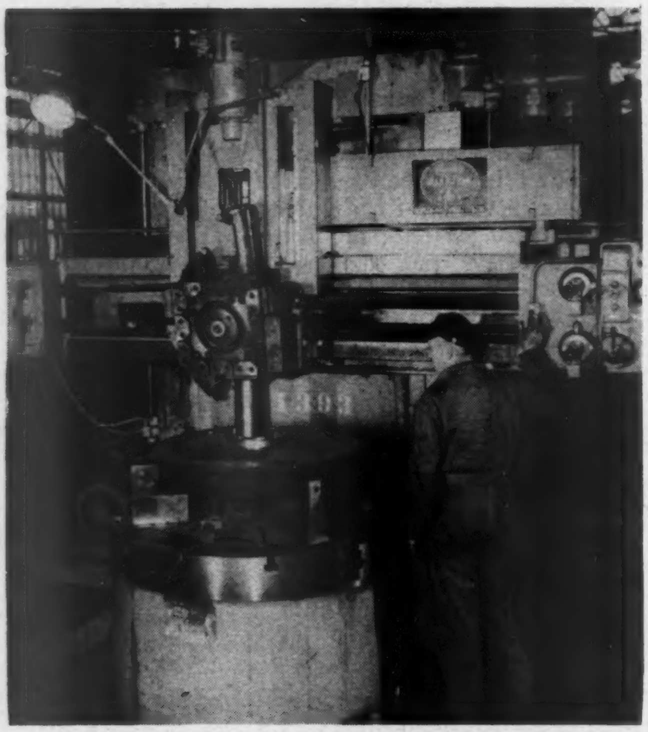
One of the drawings shows the dimensions of an A-40 Diesel locomotive wheel. On the Boston & Maine these are used on road freight and switching power. The 36-in. wheels are used in six-wheel passenger-locomotive trucks and the 33-in. wheel in the trucks of 44-ton switchers. The drawing indicates the close limits to which the machined surfaces must be held. The outside hub, next to the journal box is finished on the surfaces *E, F* and *G* for the application of the water guard which is shrunk on the outer hub. The inner hub surfaces *B, J, H* and *C* must be finished to 20 micro-inches because of the felt wipers in the gear-compound retainers in the traction-motor gear housings.

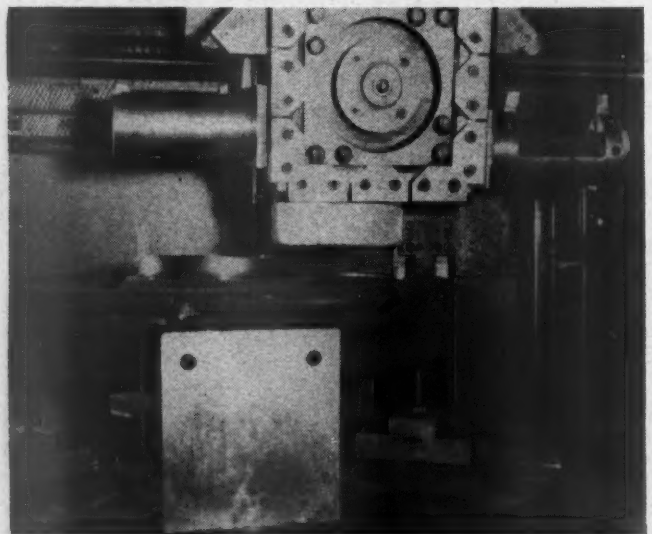


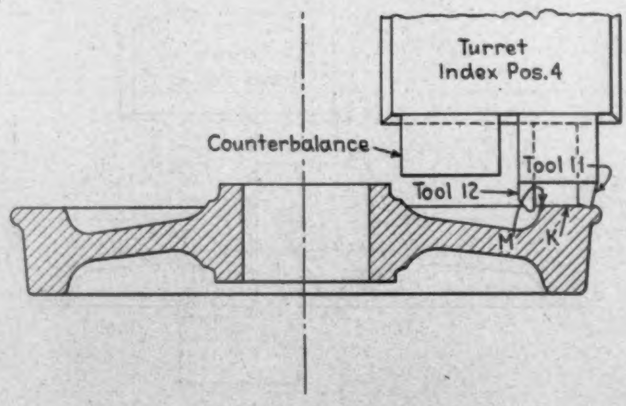


Operation No. 22

Here, in Position 2 of the turret, the semi finishing operations are done and the contours of the angles are machined

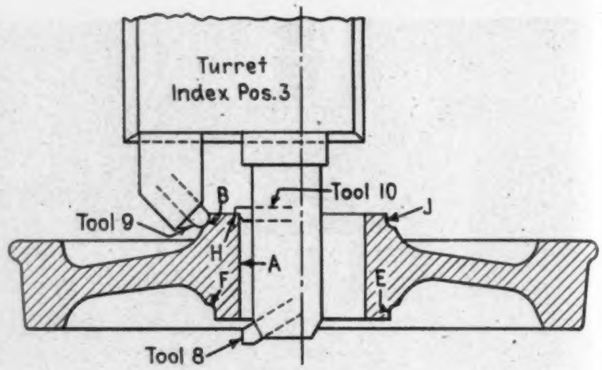






Operation No.37

In this final position the automatic functions are not used; the rim is faced and the wear limit groove is cut—manually



Operation No.30

In this turret position the finishing operations are performed; radii finished to close tolerances and the chamfer is cut

The former method of machining these wheels was to chuck them in a Bullard 54-in. vertical turret lathe and perform the operations shown in Table I by manual control. The old method required two chuckings, the wheel being turned over after operation No. 8, shown in the table. Under the old methor 9 of the 14 operations involved the use of high-speed steel tools, the remaining 5 operations making use of carbides. On the new Man-Au-Trol all the tools are carbides and Table II shows the performance of these tools on A-40 wheels.

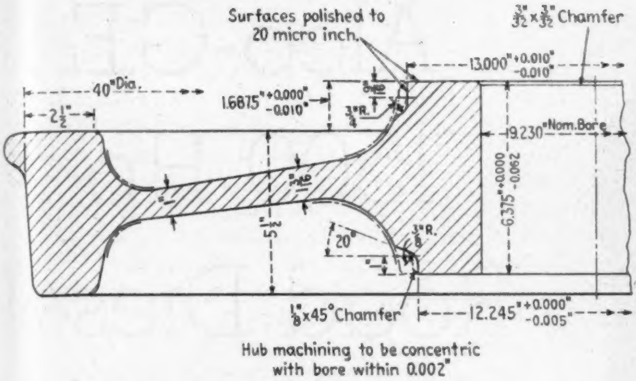
Detail Machine Operations

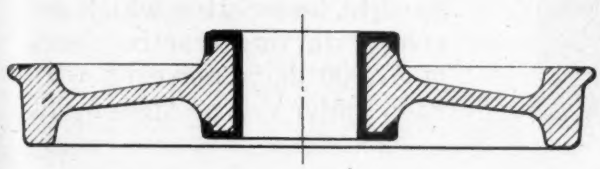
The operation data for the actual machining of an A-40 Diesel locomotive wheel is shown in detail in Table III. The 16 columns of the table show the movements of the main head of the machine (no side head is used on this job); the turret index positions (of which there are four); the tools used (the tool numbers refer to the detail tool drawings on page 00); the machine performance data; the dimensions of the work (columns 11 to 15 inclusive) and the time consumed for each machining operation (the traversing time between machining operations is included in the machining time).

After the wheel is chucked and the turret indexed to position 1 the head feeds left to position for the first metal-removing operation 4 which is to rough bore the surface *A* with Tool No. 1, the head feeding down to perform this operation. In a continuation of the same movement of the head Tool No. 4 roughs out the radius *B*, the head then feeds right to position for the operation of straddle-facing both top and bottom hub faces with Tools No. 2 and 3 mounted in a special boring bar. The head then traverses left and up and the turret indexes to position 2. In this position the bore *A* is semi-finished to an inside diameter of 9.215 in. with Tool No. 5 and the outside diameter of the hub *E* is turned with Tool No. 7 with a downward movement of the head. The 20-deg. angle *F* is machined with Tool No. 7 by the combined left and downward feeding of the tool. This combined feeding, in two directions at the same time, is a function that the Man-Au-Trol performs with mathematical precision to produce surfaces of predetermined angle.

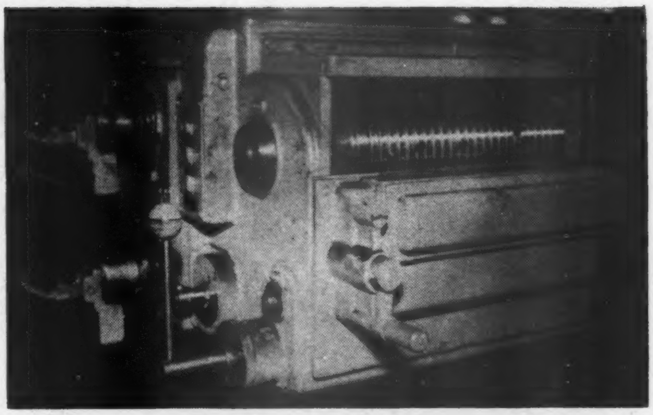
After finishing *E* with Tool No. 7 the same tool is moved by automatic control left and down, at the same time to cut a 45-deg. chamfer *G* on the outside of the hub. This operation moves the head in position to bring Tool No. 6 into play to finish face the hub surface *C*.

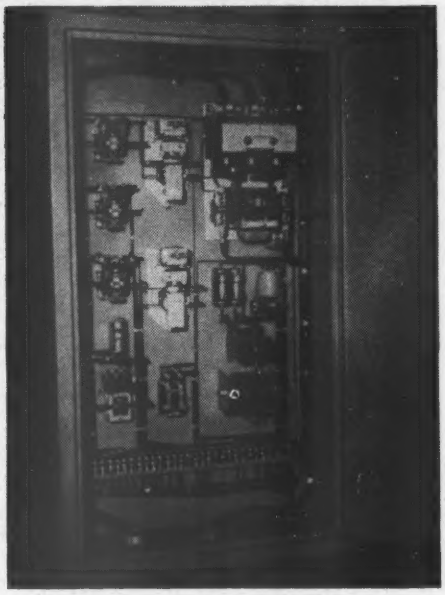
In turret index position 3 the finishing operations are





The upper drawing is a detail of the A-40 Diesel wheel and the lower drawing shows the stock which must be removed





The drum shown above is one of the two units of the machine that control the operations—The relay cabinet at the right contains the electronic controls

performed. Surfaces *A, H,* the radius *B* and hub diameter *J,* are all finished to final dimensions with Tools No. 8, 9 and 10. Then the turret indexes to Position 4, the head traverses to the right and to position, the automatic control is thrown out and the head is fed manually in operation 37 and 38 to take a skim cut off of the wheel rim K, for gauging purposes, and the final operation is to cut the wear limit groove *M*. The automatic control is thrown in again and the machine is ready to start another cycle of operations.

Table III—Operation-Data for A-40 Diesel Wheels on Bullard 54-inch Man-Au-Trol

Oper. No.	Main Head Movement: Tr.	Feed	R	L	Up	Down	Operation	Turret Index Position	Tool in Use	Work Diam. in.	Length of cut In.	Surface ft. per min.	Table Speed r.p.m.	Feed-in. per rev.	Time* min.	sec.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1	x	–	–	x	–	–	....	—	None	—	—	—	—	—	—	—
2	–	x	–	x	–	–	To position	1	None	—	—	—	—	—	—	—
3	x	–	–	–	–	x	To position	1	None	—	—	—	—	—	—	—
4	–	x	–	–	–	x	Rough bore *A*	1	1	9.000	6.500	115	50.4	.020	8	00
5	–	x	–	–	–	x	Rough ⅜in. radius *B*	1	4	13.500	0.750	175	50.4	.015	0	30
6	–	x	x	–	–	–	To position	1	None	—	—	—	—	—	—	—
7	–	x	x	–	–	–	Straddle face hub *C* and *D*	1	2&3	13.500	1.875	175	50.4	.015	4	00
8	x	–	–	x	–	–	....	—	—	—	—	—	—	—	—	—
9	x	–	–	–	x	–	....	—	—	—	—	—	—	—	—	—
10		Turret Indexes to Position 2							—	—	—	—	—	—	—	—
11	–	x	–	x	–	–	To position	2	—	—	—	—	—	.083	—	—
12	x	–	–	–	–	x	....	2	—	—	—	—	—	—	—	—
13	–	x	–	–	–	x	Semi-finish bore *A*	2	5	9.215	6.375	180	74.0	.020	5	00
14	x	–	x	–	–	–	....	2	—	—	—	—	—	—	—	—
15	–	x	–	x	–	–	To position	2	—	—	—	—	—	.020	—	—
16	–	x	–	–	x	–	Semi-finish *E*	2	7	13.500	1.375	175	50.4	.015	3	00
17	–	x	x	–	–	–	To position	2	—	—	—	—	—	.083	—	—
18	–	x	–	–	x	–	To position	2	—	—	—	—	—	.010	—	—
19	–	x	–	x	–	x	Cut 20-deg. Angle *F*	2	7	12.245	1.500	160	50.4	.010	2	30
20	–	x	–	–	–	x	Finish *E*	2	7	12.245	1.375	160	50.4	.010	2	00
21	–	x	–	x	–	x	Cut 45-deg. chamfer *G*	2	7	12.245	.250	160	50.4	.015	0	30
22	–	x	–	x	–	–	Finish bottom face hub *C*	2	7	12.245	1.875	280	88.0	.010	3	00
23	x	–	–	–	x	–	....	2	—	—	—	—	—	—	—	—
24		Turret Indexes to Position 3							—	—	—	—	—	—	—	—
25	x	–	–	x	–	–	To position	—	—	—	—	—	—	—	—	—
26	–	x	–	x	–	–	To position	3	—	—	—	—	—	.010	—	—
27	x	–	–	–	–	x	To position	3	—	—	—	—	—	—	—	—
28	–	x	–	–	–	x	Finish bore *A*	3	8	9.223	6.375	210	88.0	.015	8	00
29	–	x	–	–	–	x	Chamfer bore *H*	3	10	9.223	.250	180	74.0	.020	0	15
30	–	x	x	–	–	–	Finish ⅜in. radius *B*	3	9	13.000	1.125	250	74.0	.015	1	15
31	–		–	–	x	–	To position	3	—	—	—	—	—	.083	—	—
32		x	x	–	–	–	To position	3	—	—	—	—	—	.010	—	—
33	–	x	–	–	–	x	Finish hub diam. *J*	3	9	13.000	1.125	250	74.0	.010	1	00
34	–	x	–	x	–	–	Feed left to clear tool	3	—	—	—	—	—	—	—	—
35	x	–	–	–	x	–	....	—	—	—	—	—	19.7	—	—	—
36		Turret indexes to Position 4					....	—	—	—	—	—	—	—	—	—
37		Manual operation - Face rim *K*					....	4	11	40.000	3.500	200	19.7	.015	12	00
38		Manual operation - Cut wear limit groove *M*					....	4	12	35.000	.250	180	19.7	.015	5	00
39	–	x	–	–	–	–	To starting position	—	—	—	—	—	—	—	—	—
40		Turret indexes to Position 1					....	—	—	—	—	—	—	—	—	—
												Total Cutting Time			56	00
												Loading & unloading			8	00
												Floor-to-floor time			64	00

*Combined cutting time and machine movement time

Alco-G.E. 1500 Hp. Road Diesel

Freight locomotive which develops starting tractive force of 57,500 lb. is powered with 12-cylinder V-type Alco engine

THE American Locomotive Company-General Electric 1,500-hp. road freight locomotive is designed for heavy road haulage and is used in one-, two-, three- or four-unit locomotive operation.

Powered by a 1,500-hp. turbo-supercharged V-12 Diesel engine, the locomotive is 51 ft. 6 in. in length between knuckles with a maximum height of 14 ft. 10 in. and a maximum width of 10 ft. 6½ in. Four electric traction motors, geared to each of the four driving axles, deliver a starting tractive force of 57,500 lb. at 25 per cent adhesion. With 65 m.p.h. gearing it has a continuous tractive force of 42,500 lb.

This unit has capacities of 200 gallons of lubricating oil, 1,200 gallons of fuel oil and 250 gallons of engine cooling water.

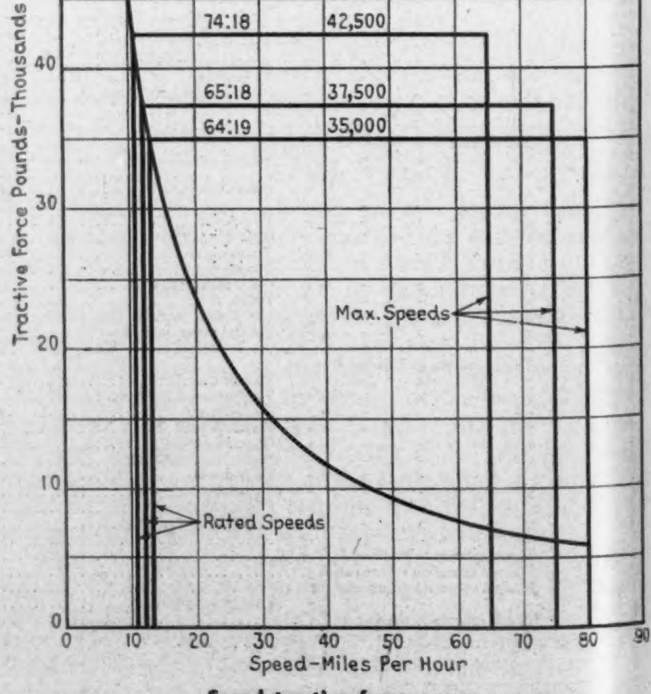
The Diesel engine is an Alco Series 244, V-type and has 12 cylinders with 9-in. bore and 10½-in. stroke, supercharged with the G.E. turbo-supercharger. A four-cycle engine, it has two intake and two exhaust valves per cylinder. Construction includes a unit fuel injection system, water-cooled cylinder liners and heads, trunk-type oil-cooled pistons, forged steel connecting rods, seven-bearing crankshaft and welded cylinder block and base.

Engine lubrication through a full-pressure system is provided by a gear-type pump integral with the engine, oil being supplied from the 250-gallon reservoir in the engine base. Filters are of the full-flow type. The lubricating oil is cooled by a single-pass cooler. Failure of the engine lubricating-oil system automatically stops the engine.

An electrically driven transfer pump, located in the engine room, supplies fuel from the supply tank to the injection pumps. The supply pipe to the transfer pump is fitted with a duplex waste-packed filter on the suction side and a felt filter on the discharge side. In the discharge pipe from the transfer pump there are a pressure relief valve and a pressure gauge.

Engine cooling is accomplished by a gear-driven centrifugal pump, integral with the Diesel engine, which circulates water through the engine, radiators and lubricating oil cooler. A radiator of the panel type is mounted in the roof compartment at the rear end of the engine compartment.

The 72-in. aphonic radiator fan is driven through a right-angle gear box and an eddy-current clutch. The eddy-current clutch is located between the gear box and the Diesel drive-shaft coupling. This type clutch provides a damper in the drive system against shocks or torsional vibrations and permits a superior modulated fan-speed control. Air is drawn through the radiators



Speed-tractive-force curve

and exhausted through a screened opening in the roof.

The thermostat-controlled fan speed and the shutters are so synchronized that when the shutters are closed the fan does not run. When desired, the fan can be stopped entirely, independently of the Diesel engine. Temperature control for the engine is thus reduced to one variable—the temperature of the jacket water. Shutters can be closed manually during stand-by periods.

The electric transmission system consists of the main generator, an amplidyne exciter, and four traction motors, one mounted on each of the four driving axles. A gear-driven auxiliary generator is also included to supply power for lighting, battery charging and control circuits. It operates at constant voltage under control of a regulator. A second identical auxiliary generator provides power supply to operate the two motor-driven traction-motor blowers.

The 10-pole main generator, direct-connected to the Diesel engine, is designed to transmit power to the traction motors over the operating speed range of the locomotive. It is constructed with a single low-voltage, separately excited winding for amplidyne excitation. Using a special starting winding and current from the storage batteries, the main generator acts as a motor for starting the Diesel engine.

The four traction motors are G.E.-752 motors. These are four-pole, d.c., commutating-pole motors designed for operation with full or shunted field. Each pair of traction motors are ventilated by a multivane d.c. motor-driven traction-motor blower.

Mounted on the generator and connected into the shunt-field winding of the generator, the amplidyne exciter functions to increase or decrease generator output by increasing or decreasing current supplied to the field. Utilizing exceptionally low current from the control circuit, the amplidyne exciter amplifies this low current to provide a magnitude and speed of generator field control to produce maximum locomotive performance.

The engine control equipment is in a single panel located in the engine room in a convenient position for observing engine operation during starting. The contactor compartment forms the rear wall of the cab. Packaged units of equipment are used in the control system to facilitate removal of assemblies for repair and the installation of replacement units. Connections are multipoint plugs.

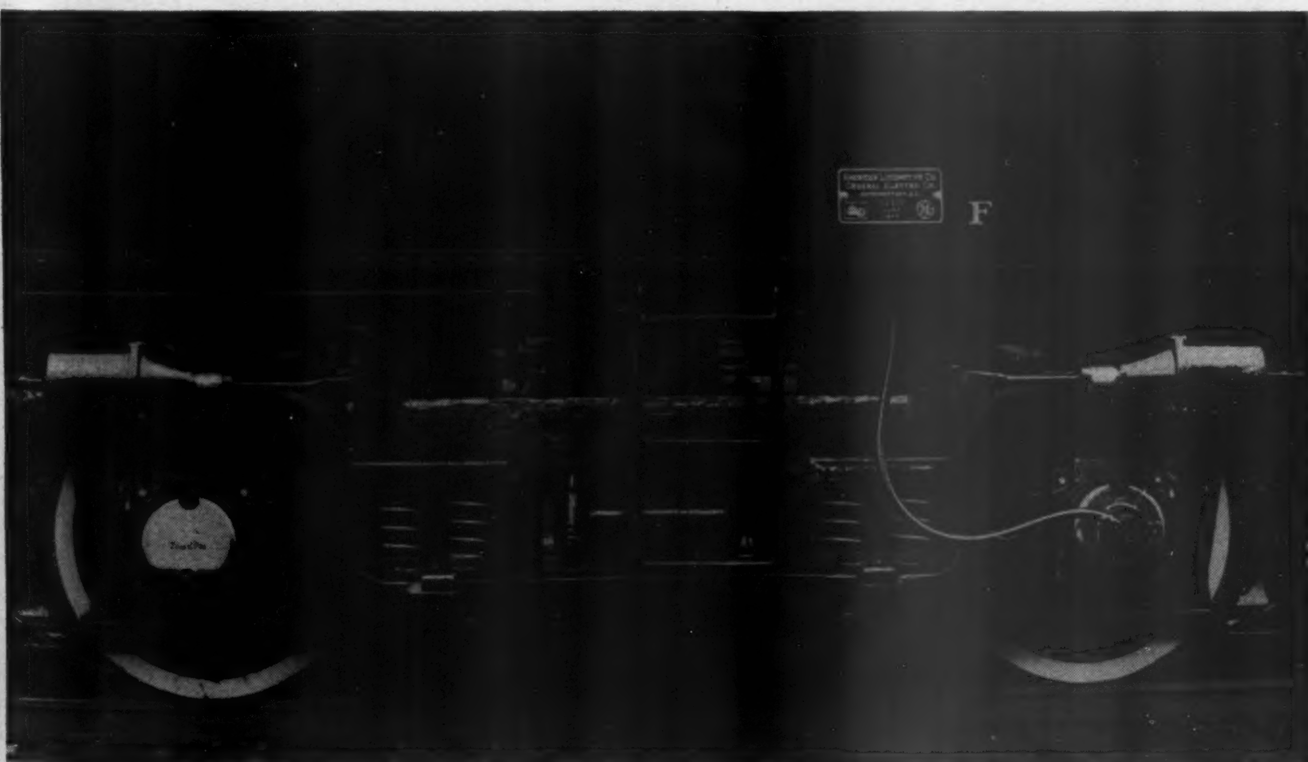
The control stand is located at the left of the engineman's position in the cab. It mounts the master controller, selector and reverser handles; the control-power, fuel-pump, headlight and train-control switches, emergency engine shutdown button, attendant's call button and warning lights. The instrument panel, in front of the engineman, mounts the air brake gages, speedometer, load-indicator instruments and wheel-slip warning lights. The instrument panel has black-light illumination. Electrical control equipment as well as switches for motor cut-out control and ground-relay cut-out are located in the contactor compartment.

The control system is a Type P single-end multiple-unit control. All reversers and line contactors are electro-pneumatically operated while all other contactors function magnetically.

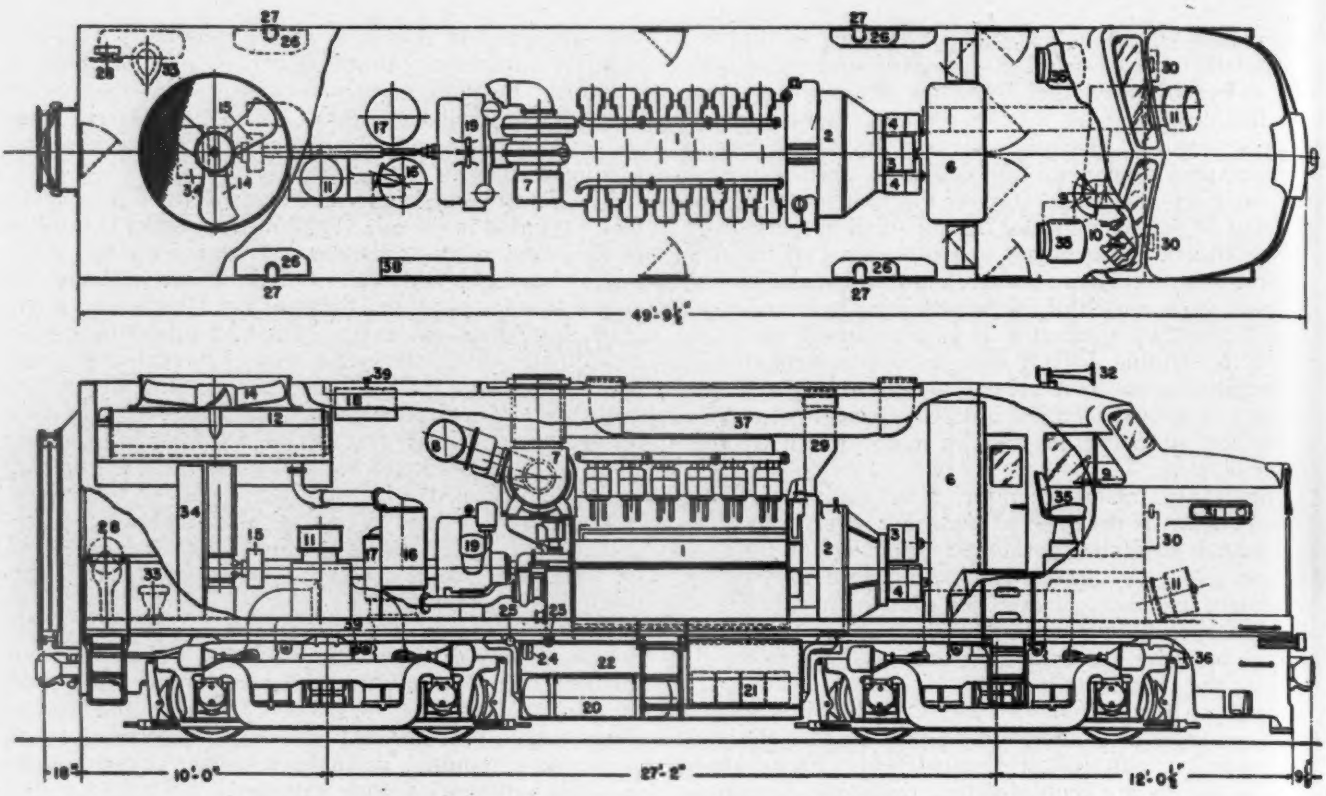
A selector handle on the control stand operates transition, both forward and back, manually. There are four traction motor connections: series-parallel full field, series-parallel shunt field, parallel full field, and parallel shunt field. On auxiliary circuits, wherever overload protection is required, manual low-voltage circuit-breaker switches with reset feature are used.

The G.E. electro-hydraulic power-plant regulator automatically governs the engine-generator system. The performance called for by the engineman is furnished within safe limits of engine speed, power and torque.

The regulator includes an engine-driven tachometer generator, a control panel and an engine-mounted servo unit operated by an independent oil pressure system. Electrical interconnections balance the mechanical action of the servo unit on the engine fuel racks against electrical output of the tachometer generator. This output is proportional to the engine speed.



The four-wheel truck has roller bearings and two traction motors



Key to location of equipment on Alco-G.E. 1,500-hp. road freight locomotive

1—Engine
2—Main generator
3—Exciter
4—Auxiliary generators
5—Traction motors
6—Contactor compartment
7—Turbosupercharger
8—Turbosupercharger filters and silencers
9—Control stand
10—Brake valves
11—Traction motor blowers
12—Radiators
13—Radiator shutters
14—Radiator fan
15—Radiator fan clutch
16—Lubricating oil cooler
17—Lubricating oil filters
18—Engine water tank
19—Air compressor
20—Main air reservoirs
21—Batteries
22—Fuel tank
23—Fuel tank filling connection
24—Fuel tan gauge
25—Emergency fuel cut off
26—Sandboxes
27—Sandbox filling holes
28—Hand brake
29—Generator air duct
30—Cab heaters
31—Number boxes
32—Horn
33—Toilet
34—Tool box
35—Seats
36—Bell
37—Dynamic brake grids and blowers (modification)
38—Engine control panel
39—Engine cooling water filling connections

Movement of the engineman's throttle changes the panel circuits, causing instant servo action on engine fuel supply to achieve the engine speed and power called for. Servo action is automatically limited to a precise schedule for each engine speed to limit the engine torque.

Excessive load demand from the generator-traction-motor system is relieved by an overtravel feature built into the servo unit. This feature operates through the amplidyne exciter to reduce generator demand whenever the permitted fuel does not maintain the engine speed.

Electrical feedback provisions are included to promote stable operation over a wide speed range and to anticipate transient engine load changes originating in the generator-traction-motor system.

Overspeed protection is provided by an overspeed trip switch which automatically cuts off the fuel supply when the engine overspeeds. If engine lubricating-oil pressure drops to the danger level, a pressure-protective switch drops the engine speed to idle. A ground relay removes power and brings the engine to idle speed in the event of a ground failure in the main power circuit. High engine temperature causes a red warning light on the control stand to be illuminated.

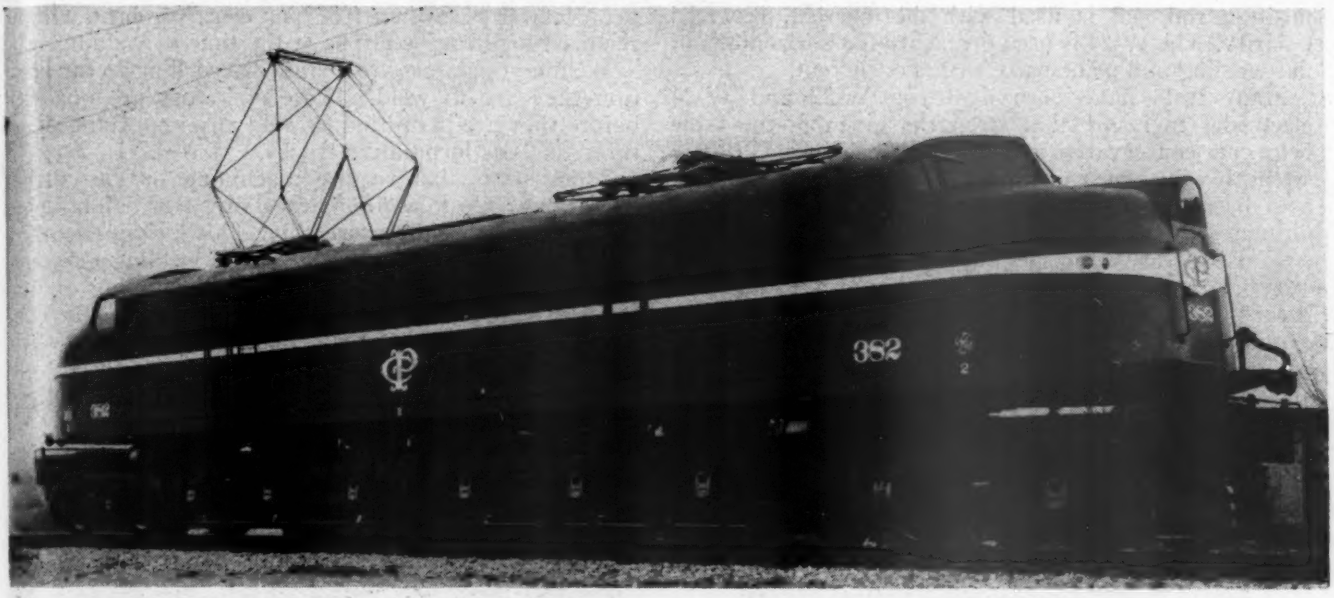
The underframe is of steel construction, fabricated by electric welding. Truck center plates of cast steel are welded to the rolled-steel frame and are equipped with hardened steel liners. Standard Type E top-operated swivel couplers, provided with side uncoupling levers, are housed in cast-steel pockets.

The superstructure of the locomotive is of truss-frame steel construction, enclosed with Plymetl paneling. The operating cab floor is elevated above the floor of the engine compartment and is linoleum covered. The walls and roof are lined and insulated. Two upholstered, cushioned seats with adjustable features are provided. Two fixed windows form a high-visibility windshield, and the side windows are combination-type, having controlled drop sections and pivoted front sections. All windows are of safety glass.

Each unit has two four-axle, swivel, swing motion, pedestal-type motor trucks. Of cast-steel construction, the truck frames are spring-supported on two equalizers on each side with triple coil springs between the equalizers and the frame. Triple elliptic springs are used between the spring planks and bolsters. The center plates are equipped with safety locks.

Forged open-hearth-steel axles, with 6½ in. roller-bearing journals, mount 40-in. rolled-steel wheels. All axles are driving axles with axle-supported motors having spring nose suspension on the truck transom. All wheel and axle assemblies are removable with the motors. Forced ventilation for the traction motors is provided through flexible connections between underframe ducts and the motor frames. Hardened spring-steel liners are used on truck pedestal jaws and journal boxes, with high-carbon-steel liners for center plates. Side bearings are of plain steel with swivel-limiting devices.

The trucks are equipped with clasp brakes on all wheels. There are two brake shoes per wheel, and the braking system is operated by four 10-in. by 8-in., single-acting brake cylinders per truck. A hand brake is located outside the rear end of the rear hood.



A General-Electric passenger locomotive built for the Paulista Railways of Brazil, the driving and guiding truck frames of which are of welded construction

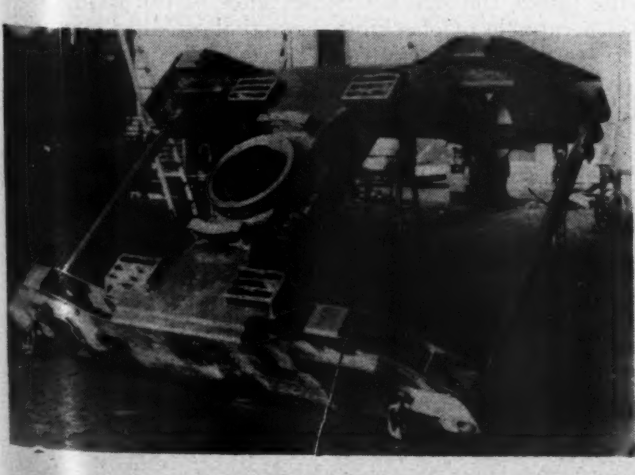
Welded Locomotive Trucks

By F. H. Brehob and W. H. Cochran

Electric locomotive truck frames, which were in the past generally built up by bolting or riveting, are now generally integral structures, either cast or welded. Integral cast frames are familiar to all railroad motive-power men but welded frames are not as well known, although many are in service. For this reason it seems worth while to review experience with welded trucks and to outline procedures of design and manufacture.

The first welded trucks built to G.E. design were manufactured in 1928. These trucks were applied to a 300-hp. 72-ton Diesel-electric switcher locomotive operated by the American Rolling Mill Company at Middletown, Ohio, where they have given uninterrupted successful service.

From this beginning the standard line of Diesel-electric industrial and railway locomotives for the past several years has been built almost entirely with welded trucks. Up to the present time there are more than 1,500 locomotives in industrial and railroad service with welded truck frames. A large portion of these are 44-ton Diesel-electric locomotives. This particular truck frame is conspicuous for its extreme lightweight necessitated by the limitation of locomotive weight.



An early welded truck frame for a 300-hp. Diesel electric locomotive

The first road locomotives with welded trucks were built for use in South America. Notable among these are four locomotives built for the Paulista Railroad in 1939 for passenger service. These locomotives are built to operate at speeds up to 90 m.p.h. Each weighs 185 short tons (168 metric tons) and is loaded at 45,000 lb. per driving axle. Twenty-two locomotives of this design have been shipped to the Paulista Railroad.

In addition, 20 locomotives for main-line service have been built with welded truck frames for the Sorocabana Railway of Brazil and are now in service. Fifteen duplicate locomotives are now on order for the Sorocabana Railway. A set of locomotive welded trucks recently were built for the Mexicano Railroad of Mexico. These are now replacing trucks of bolted steel castings built about 23 years ago.

Early in 1946 a 6,000-hp. three-unit locomotive was placed in service with welded trucks on an American railroad. This locomotive is now in high-speed passenger service. Similar locomotives for lower-speed service with welded trucks are now in operation.

Welded trucks are designed to be fabricated by arc welding. The welding electrodes almost universally used for trucks are General Electric Company's W-22 and W-24. The former corresponds to American Welding Society Specification 6010 and the latter conforms to AWS Specification 6020. Both electrodes are of the low-carbon-steel shielded type. The W-22 is an all-

position rod and is used with d.c. current, reversed polarity. The W-24 is used primarily for horizontal and flat welding and principally with a.c. current.

Many tests have been made on W-22 and W-24 electrodes to insure that strengths given in the table below are conservative and can readily be met. Ultimate strength values of groove and fillet welds that are used as a basis of design are conservative. The minimum ultimate strength of groove welds on the low-carbon steel used is 55,000 lb. per sq. in. with a yield point of 40,000 lb. per sq. in. Fillet weld strengths in ultimate shear per linear inch are given as follows:

Size fillet welds, leg in. or throat equivalent	Ultimate strength, lb. per linear in.
1/4	11,000
5/16	13,000
3/8	14,000
7/16	17,000
1/2	18,000
9/16	19,000
5/8	21,000
3/4	25,000

In applying the above values to the design, an adequate factor of safety is used. In general, sufficient weld is specified to make the strength of the welded joint commensurate with the strength of the material. The design is such that all welds are accessible and where necessary, adequate weld preparations are indicated on the detailed parts of the assembly.

When making truck designs, care is taken that it is possible for the shop to weld the various parts together in the proper sequence so that the final assembly will meet the design requirements as to strength and dimensional accuracy. Low-carbon steel of good welding quality is used. In general, the carbon content does not exceed 0.30 percent.

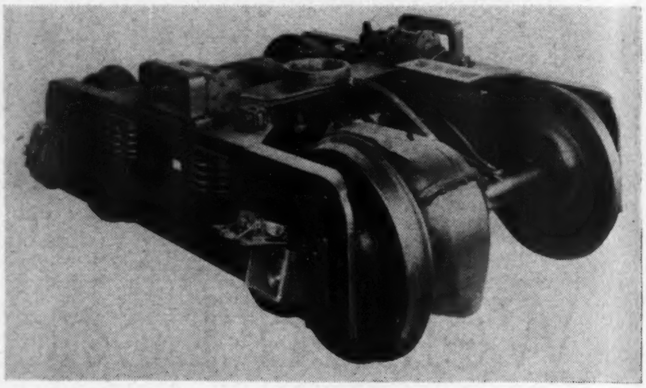
All material is covered by General Electric specifications specifying chemical and physical property and in general, conforms to materials called for on A.S.T.M. Specification A-78 or A.S.T.M. A-201. Materials used in high-stress locations such as truck side frames have a tensile strength of 55,000 and 65,000 lb. per sq. in. Ample sections are used to limit the stresses to a factor of safety of four and in some critical places a factor of safety of five.

The carbon, manganese and silicon content of low-carbon steel to be welded is limited by the formula $X\ C + \frac{1}{4}\ X\ Mn + \frac{1}{4}\ X\ Si = 0.46$ per cent. For example, if carbon is .28 per cent, this formula becomes $.28\ C + .07\ Mn + .07\ X\ Si = 0.42$ per cent. In special cases where steel is used with an analysis such that the formula $X\ C + \frac{1}{4}\ X\ Mn + \frac{1}{4}\ X\ Si$ is above 0.46 per cent but less than 0.55 per cent, pre-heat will be required for heavy sections at the time of welding.

Welding operators are qualified according to the position they are to weld. These operators are qualified before they are permitted to weld any important structures, such as locomotive trucks.

Truck parts that require machining or gas-cutting operations prior to welding are so prepared before being brought to the welding assembly. This includes welding preparation where required. These welding preparations are made either by gas cutting, chipping or machining, whichever method is most suitable for the conditions involved. The various parts are set up in their correct relationship by means of clamps or fixtures.

Frequently, heavy sections (or the junctions of light sections with heavy sections) are pre-heated immediately prior to making the weld. This is done to prevent rapid cooling in the weld to minimize danger of hard spots in the weld. Depending on the size of weld, more than one pass may be used, care being taken to clean off the slag before the succeeding pass is applied.

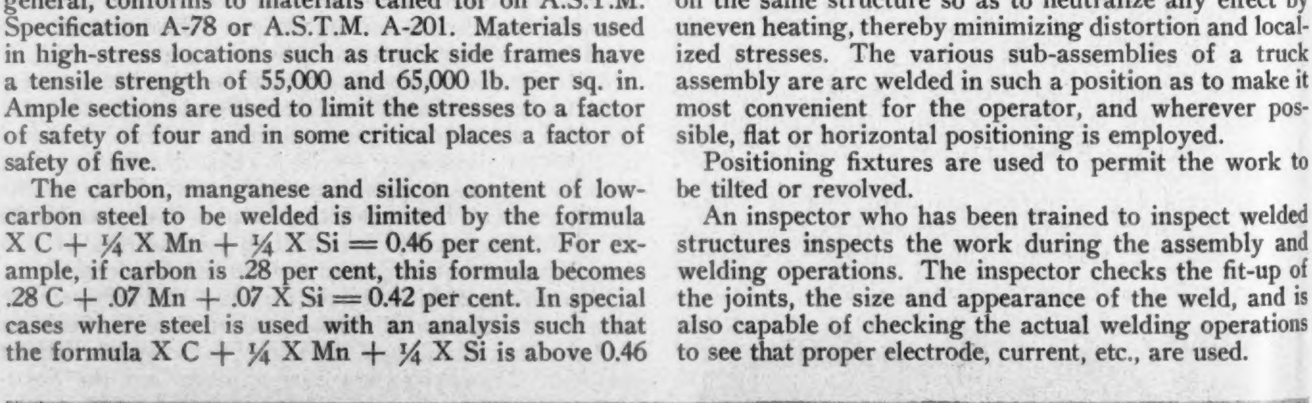


A welded truck for a G.E. 44-ton Diesel-electric locomotive

Frequently two or more welders work simultaneously on the same structure so as to neutralize any effect by uneven heating, thereby minimizing distortion and localized stresses. The various sub-assemblies of a truck assembly are arc welded in such a position as to make it most convenient for the operator, and wherever possible, flat or horizontal positioning is employed.

Positioning fixtures are used to permit the work to be tilted or revolved.

An inspector who has been trained to inspect welded structures inspects the work during the assembly and welding operations. The inspector checks the fit-up of the joints, the size and appearance of the weld, and is also capable of checking the actual welding operations to see that proper electrode, current, etc., are used.



The welded driving-truck frame for a Paulista Railways electric locomotive built by General Electric

EDITORIALS

Winter Is Only Six Months Away

Fortunately, memories are sometimes conveniently short. Less than six months ago the railroads of the northern and eastern United States were not yet in the midst of the battle to keep things moving in the face of one of the most severe winter seasons in several years. Yet it was a matter of only a few weeks more before passenger trains were running hours late with snow piled up and temperatures below zero. Worse than that, from the standpoint of the customers, was the fact that because passenger travel was still at near war-time volume most main line trains were long trains and long trains are sometimes difficult to heat.

If there was any one problem of passenger-train operation that caused more trouble than train heating last January and February it was not apparent at the time, probably because some of the rest of the problems were old ones that had been suffered with so long that railroad men had become inured to them.

This matter of train heating is an old problem too—it has been with us as long as we've had trains to heat. It took the Diesel locomotive, though, to bring the matter of train heat right out in front where it became a major trouble instead of a minor one. When trains moved by steam power alone it was always possible to rob a few thousand pounds of steam from the supply needed for traction and try to keep the customers warm, at least while the weather was postponing their chances of arriving on time. But, you can't do that with a Diesel. The limitations of space have decreed that there can be just so much steam generating capacity on each unit of a Diesel locomotive and when that capacity is used up—well, it's used up.

It may be worth while to look this matter of train heating and steam generating capacity squarely in the face; a lot of people in the railroad and manufacturing businesses are trying to hang the blame for all the troubles on the other fellow.

How much steam does it take to heat a 14-car train moving 70 miles an hour in zero weather? Does anyone know? It seems strange that with all the wealth of knowledge and experience that technical societies such as the American Society of Heating & Ventilating Engineers have made available there should be so much controversy over train heating. The answers should not be too difficult to find. Whether or not the last six cars on a 14-car train are warm enough depend on a lot of things: adequate initial steam capacity; design of cars; adequate insulation and other structural factors that reduce heat losses; modern heat control equipment; well insulated steam lines of *sufficient size and capacity;* efficient steam heat connectors, and, above all, the kind of rigid discipline in the matter of inspection and maintenance of the steam heating system that will make sure that, with all other factors up to par, the priceless steam that starts out from the head-end actually gets to where it is needed most. With train-line losses due to condensation, or leaks due to sloppy maintenance, the best steam generator ever built hasn't got a chance.

The problems of steam generation and distribution in train heating aren't any more difficult of solution than a lot of other problems that have been brought to light in connection with Diesel operation of passenger trains. One thing is certain, however. The Diesel is such a valuable asset as passenger train motive power that the railroads can afford to leave no stone unturned to find the answers. Some of those who have thought seriously about this have indicated that many railroads might have a lot less trouble next winter if the intervening six months were spent in setting up an air-tight inspection and maintenance routine and installing some 2½-in. steam train lines to replace present 2-in. lines instead of expending energy trying to find a way to put more steam generating capacity on the head-end.

Changing Perspectives

For a long time the eight-hour rating has been accepted for passenger-car storage batteries. It means that a fully charged battery will produce its rated ampere-hour capacity, if this is done at a uniform rate over a period of eight hours. If a battery is discharged in a shorter time, its ampere-hour rating will be less. With present electrical loads and with batteries on an axle-powered car in an average road state of charge, they may be able to carry the load for only one and one-half to three hours.

The primary reason for this situation is enormously increased electrical loads. Batteries have been increased in size, but it is impracticable to have a battery which would carry a warm-weather air-conditioning load for eight hours. In many cases, the margin of battery capacity has become dangerously low. On newer cars, the margin has been increased appreciably by three means.

First, the batteries were increased somewhat in size. Second, the practice of using dual compressor motors or axle-driven motor-generators with 10- or 15-hp. standby motors has been displaced by motor generators consisting of generators rated 25-30 kw. and 25-hp. motors. Third, standby power facilities in yards and terminals are being improved in some important places.

There is one thing which must be appreciated. The old order has changed. Once upon a time red, green and

sometimes blue car plush made the upholsterer's problem a simple one, but now he must live with the beautiful light-colored fabrics which do so much to make attractive car interiors. Similarly, the operators and electrical maintainers must learn to work on narrower margins. They may not like it any better than the upholsterers, but the situation is apparently one which must be lived with, and something which can best be done when the circumstance is accepted.

Minimizing the Noise Level in Passenger Cars

During the recent meeting of the railroad division of the American Society of Mechanical Engineers, some figures were brought forth that strikingly demonstrate the need for an understanding of the basic principles of acoustics to get maximum, or even substantial, benefit from a program aimed at reducing the noise level in passenger cars. One of the laws of acoustics illustrated by these figures that can save a railroad a lot of needless work and at the same time be of great value in keeping passenger car noise level to a minimum is that governing the total noise level produced by two or more sounds being generated at the same time. For example, the combined level of two sounds of 100 decibels each is 103 decibels. It requires only brief consideration of this phenomena to realize that under the conditions where this law applies the only way to make a significant reduction in the total noise level within a car is to reduce both component noises substantially. Even if one noise were to be eliminated completely, the total gain would be only a reduction of three decibels in the total noise level. If both noises could be cut in half, however, the total noise level would be reduced by 50 per cent, or about 50 decibels.

Further figures contained in the report show how two unequal noises occurring simultaneously combine to form the total noise level. A noise level of 95 decibels added to one of 100 decibels results in a total level of 101.2 decibels, while 90 decibels will combine with 100 decibels to form a total decibel level of 100.4. As the spread between the large and the small noise becomes greater, the amount by which the total noise level exceeds the larger noise becomes increasingly smaller. In such cases it is easily seen that a reduction in the small noise will have no noticeable effect on the total noise level. It is further evident that a reduction in the large noise up to the numerical difference between the large and small noise in decibels will reduce the total noise level by nearly the amount by which the large noise is reduced. Beyond this point both noises will have to be reduced equally to get an appreciable reduction in the total level of noise. The only case where it would be desirable to reduce one noise drastically would be where the large noise greatly exceeded the small noise.

The above instances of the behavior of sound don't begin to cover the field of passenger-car noise reduction, but they do serve to emphasize some factors that must be taken into consideration to minimize the total noise level within the car. The examples were limited to two sounds rather than the many which go to make up the total noise level because this limitation simplifies explanation of the principles involved and because the behavior of many sounds is governed by laws similar to those which determine the behavior of two sounds. The examples do serve, however, to show why all important sound components must be controlled to obtain a significant reduction in the total noise level produced by the components. They further show why an understanding of acoustic theory is necessary to obtain more than a fraction of the possible benefit obtainable from a program to reduce noise level. They serve also as a reminder to railroad men that the science of acoustics is a complex one, and that where serious problems of noise are involved, the employment of experts in this field is necessary and will save time and money in the long run as well as aiding passenger business by giving the passenger a quiet ride.

Diesel Locomotive Questions and Answers

The maintenance of Diesel-electric locomotives has become in a relatively short time a problem of major importance to all except a few railroads. The rapidity with which the Diesels have been tossed into the laps of the motive-power departments has given a new responsibility to those who formulate the maintenance policies and to the men down the line who do the hundreds of servicing and repair jobs that must be done if the maximum service is gotten out of this valuable equipment. In an attempt to be of the greatest possible help to the mechanical department and particularly to the men in the shop in meeting that responsibility the *Railway Mechanical Engineer* is introducing in this issue a Diesel locomotive question-and-answer department.

Most of the men in the Diesel shops and terminals are supervisors, mechanics, electricians and helpers who have had years of experience with steam power. The differences between steam and Diesel-elctric locomotive maintenance are so great that the outstanding performances being turned in by the Diesels are really a very fine tribute to the ingenuity and resourcefulness of railroad shop men. Besides coping with the basic differences between the internal combustion engine and the reciprocating steam engine the shop forces have had to meet the changes in maintenance practices caused by the greater degree of precision used in building the Diesels. They have plunged into the job of keeping the locomotives running on tight schedules and they have had to get on-the-job experience and training. They have been helped greatly by the service engineers and instruction manuals of the builders but they know that there are many more details to learn.

The author of the new question-and-answer column is one of the outstanding railroad shop men in the railroad industry with a background of many years of Diesel-

electric locomotive experience that embraces both locomotive operation and maintenance. For business reasons he has chosen to remain anonymous but all questions sent in for answer to the editor, *Railway Mechanical Engineer,* 30 Church St., New York 7, N.Y., will be forwarded for answering and will be published as soon as possible. Questions will be welcomed by this department and will be particularly helpful as a guide in the selection of the material that will be most useful to shop men.

The shop forces are gradually finding out ways to improve the quality of the work and at the same time they are looking for ways to raise the efficiency of the shop operations. We believe that the Diesel locomotive questions and answers will help them in reaching both objectives.

Freight-Car Supply Increasing—But Slowly

For the past two years a tremendous struggle has been going on to rehabilitate the freight-car supply of American railroad. This struggle has involved the railroads, the car-building industry, the steel industry, and the government. The results have been, and continue to be, disappointing. The attempts to establish freight-car building programs, first, of 7,000 cars a month, and then of 10,000 cars a month, made during 1947 are an old story. Neither of these programs was considered adequate to increase the total number of cars available to a point where demands for railway transportation could be comfortably met. This led to the proposal of the so-called Harriman committee that a program of 14,000 cars a month be established and that it be protected with priorities, if necessary, to provide the necessary steel.

None of the goals set or suggested has yet been met. The nearest to meeting the 10,000-cars-a-month goal was in December, 1947, when the total production was 9,823 freight cars for domestic use. Since then, the average has been about 9,000-cars a month. The 14,000-cars-a-month program has dropped out of sight because the needs of steel in other industries would not stand the sacrifice required to implement it.

What, then, are the prospects for an increased freight-car inventory by October, 1948, when the volume of traffic on American railroads is at its annual peak? Last October showed a decline of 84,000 cars in Class I railroad ownership as compared with the preceding year, and the low point was reached in November. Since then, during which time there has been no marked change in the trend of freight-car production, there has been an average gain in total cars owned or leased by Class I railroads of a little less than 3,000 cars a month. The actual figures are 14,781 cars from November to April. There is little reason to assume that the pressure for steel in other fields than railway transportation will become less insistent between now and October than they had been since last October. It would seem, therefore, that with a monthly increase of 3,000 cars, the best that may be expected by next October will be a Class I ownership of about 1,755,000 freight cars of all types. Because of the decline in ownership from October to November in 1947, this will be something less than 26,000 additional cars in October, 1948, then were available a year ago.

This, of course, assumes no change in retirements from the rate prevailing so far this year. An increase in retirements will reduce the additional cars available. A reduction in retirements will increase the number. Such a change, however, is not likely to be large.

Some measure of the inadequacy of present freight-car equipment to handle the traffic offered is afforded by an examination of current figures of surpluses and shortages. The average daily freight-car surpluses, reported for the week ending May 29, totaled 21,521. For the like period a year ago there was a surplus of 7,478 cars. Freight car shortages reported in the week of May 29, 1948, totaled 14,095 and included 932 box cars, 513 flat cars, 4,975 gondola cars, 7,579 hopper cars (including 89 covered hopper cars), and all others, 96.

NEW BOOKS

GAS-TURBINE CONSTRUCTION. *By R. Tom Sawyer, B. of E., M.E. Manager, Research Department, American Locomotive Company. Published by Prentice-Hall, Inc., 70 Fifth avenue, New York 11. 400 pages, 6 in. by 9¼ in.; cloth bound. Price, $7.*

This book, a companion to "The Modern Gas Turbine," also by Mr. Sawyer, covers the construction, operation and maintenance of heavy equipment, turbochargers, and air craft gas-turbine equipment. Chapter V of Part I on Heavy Equipment is devoted to the gas-turbine locomotive. Part II on Turbochargers includes a chapter on the various methods and procedures of testing turbochargers during development. Part III is devoted to Aircraft Gas-Turbine Equipment.

FORMING OF AUSTENITIC CHROMIUM-NICKEL STAINLESS STEELS. *Assembled and edited by Vsevolod N. Krivobok, Sc.D., International Nickel Company, and George Sachs, D.Eng., Case Institute of Technology. Available through the International Nickel Company,* 67 *Wall street, New York* 5, *or the International Nickel Company of Canada, Ltd.,* 25 *King Street West, Toronto* 1, *Ont.* 308 *pages,* 8½ *in. by* 11¼ *in., cloth bound. Price,* $4.

Describes in detail modern forming procedures as applied to chromium-nickel stainless steels and as practiced in fabrication plants of the United States. Among the methods discussed in the 13 chapters of the book are bending and straight flanging, forming of curved sections and tubing, deep drawing, die forming, forming of contoured-flanged parts, and forming in various other ways. The specific examples of forming technique are supplemented by details of tool design and tool materials, lubricants, data on dimensions, and consecutive steps in fabrication.

With the Car Foreman and Inspectors

Ventilating and Heating C.N.J.'s Paint Shop

By T. R. Peyrek*

Axial-flow fans exhaust fumes and paint-laden air—Variable-temperature heater warms air for heating and drying purposes

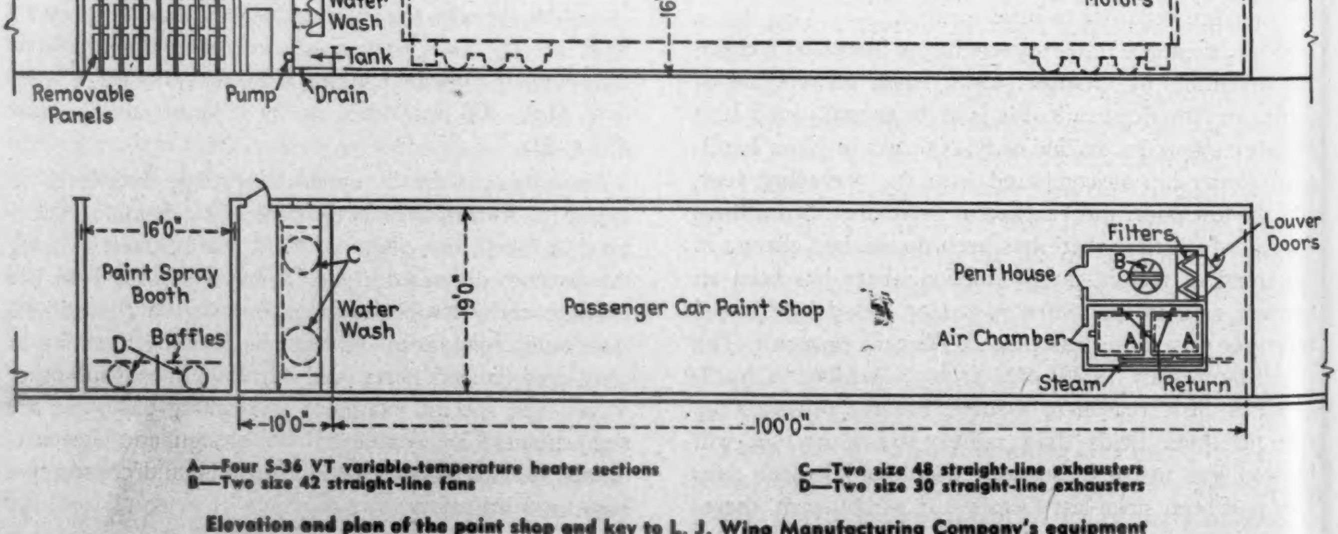
THE importance of proper ventilation in paint-spray operations cannot be overemphasized. Aside from the consideration of the health of the workmen involved, poor ventilation of paint-spray installations usually means inefficient painting and poor drying with attendant loss of time and money.

In its railroad car paint shops at Elizabethport, N. J., the Central Railroad of New Jersey has effectively solved this difficult ventilation problem and at the same time has made provision for warm air to insure the comfort and health of workmen and the rapid drying of painted cars.

A section of the repair shops has been walled off and equipped with facilities to handle both the painting and drying of railroad cars and small parts. The car painting shop is 110 ft. long by 19 ft. wide and 16 ft. high, allowing ample work room while accommodating a railroad passenger car. At the open end of the shop a large door permits the entry of the railroad cars and is closed during the painting and drying operations.

The opposite end is equipped with a water-wall installation through which the contaminated air is drawn before being exhausted to the atmosphere. The water

*Sales engineer, L. J. Wing Manufacturing Company, New York.



A—Four S-36 VT variable-temperature heater sections
B—Two size 42 straight-line fans
C—Two size 48 straight-line exhausters
D—Two size 30 straight-line exhausters

Elevation and plan of the paint shop and key to L. J. Wing Manufacturing Company's equipment

wall itself is a by-pass which guides the contaminated air in a horizontal direction through a water curtain. This water curtain is formed by the gravity flow of water over the surface of a vertical metal apron and its continual dripping from the apron to a receptacle below the by-pass. As the contaminated air is drawn through this water wash, tiny globules of paint are caught by the water and removed from the exhausted air.

Directly behind the car paint shop is the small-parts spray booth, approximately 16 ft. sq. and 10 ft. high. Both the paint shop and the spray booth are equipped with fluorescent lighting fixtures which have been made explosion proof.

The proper ventilation of these paint-spray installations was a major problem because of three important factors: (1) the presence of dangerous fumes and lead from the paint spray in the air made positive exhaustion imperative; (2) before exhausting to the atmosphere the system had to remove all traces of paint from the contaminated air, and (3) provision had to be made for warm air to be used in drying the painted cars and small parts.

Utilizing two 7½-hp. Wing straight-line duct fans at the fresh-air supply end of the car paint shop, the C.N.J. has coupled with them four Wing variable temperature heater sections. This arrangement permits any temperature variation deemed necessary in the 45,000 cu. ft. per min. fresh-air supply. The temperature variations are automatically controlled by a room thermostat in parallel with a low-limit air-stream thermostat. These variable temperature heater sections are so designed that the heating unit is continually under full steam pressure to eliminate the possibility

Spray painting a passenger car—Warm air from the variable-temperature heaters enters through the four openings in the ceiling

of bursting the tubes by condensate freezing. Reduction of air temperature is accomplished by changing the damper position and not by reducing steam pressure.

The two straight-line duct fans are mounted inside a penthouse atop the open end of the car paint shop. Outside air is drawn through the louvers in the penthouse doors and passes through a series of "Dustop" filters before entering the duct fans. Directly beneath the fans are located the four variable temperature heaters.

When the outside temperature is such that the fresh air does not need warming, these heaters are not put in operation. During cold weather, however, these heaters temper the incoming air to provide comfortable working temperatures in the paint shop. After passing through both the fans and the heaters, the air is forced through openings in the ceiling and then circulated through the shop.

At the exhaust end of the paint-spray room, two 15-hp. Wing straight-line duct fans draw the contami-

Paint-laden air is drawn through the water wall at the other end of the shop—The lighting fixtures in the ceiling and along the side walls are explosion proof

nated air through the water curtain where it is thoroughly washed before being exhausted into the atmosphere. These fans are installed in duct stacks above the roof line and are capable of removing 45,000 cu. ft. per min. of contaminated air through the water curtain.

In the small parts spray booth, two 3-hp. Wing straight-line duct fans draw the spray-laden air away from the work area and through another water wall. It is then exhausted to the atmosphere through a duct stack on the roof.

It is significant that in this ventilating system the motors which drive the supply fans and the exhausters are externally mounted. They are connected to the fan-wheel shaft by means of a V-belt drive. Since they are outside the air stream they are protected from the impurities that pass through the ducts and are readily accessible for making any necessary repairs or replacement.

When the painting of a railroad car has been completed, the painters leave the shop and the variable-temperature heaters are used to raise the temperature of the incoming air to the proper degree to perform the best drying job. This temperature is limited only by the pressure of the steam being supplied to the heater. In this installation the pressure is 50 lb. per

The paint-spray booth for small parts is also equipped with a water wall

sq. in. and each of the heater sections uses 1,000 lb. of steam per hr.

This installation has been approved by the Labor Department of the State of New Jersey.

A Review of Wheel and Axle Violations

By F. B. Rykoskey

[This article is part of a paper Mr. Rykoskey, supervisor of shops, Baltimore & Ohio, presented at the May 14, 1948, meeting of the Eastern Car Foremen's Association at New York. An abstract of the first part, which dealt with the operation of the B. & O.'s production wheel shop at Glenwood, Pa., appeared on Page (285) of the June, 1948, issue of the *Railway Mechanical Engineer*.] It is evident from the recently distributed A.A.R. reports, reviewing the activities of the Mechanical Inspection Department for the year 1947, that we are lax in the enforcement of the standards and practices given in the Wheel and Axle Manual.

Their report covered the inspection of 72 wheel shops, a few of which were credited with perfect standards in the operations and practices. While it is true that the committee reported "cooperation toward correction of irregularities was most satisfactory," this does not excuse us for having the conditions exist as found. It is interesting to note the remarks of the committee, and how well we cooperate to correct conditions when they are pointed out by the inspectors. Such conditions should never have occurred if instructions were properly administered when issued. The easiest way to do a job is the right way, and this method of working keeps the workmen alert, and at the same time keeps the supervision out of trouble. It is not work that we have at our command that worries us, or occupies our time, but the work of which we have little or no knowledge that consumes our time in explaining the reasons for its failure or recurrence.

My remarks would be incomplete without reviewing the violations in the majority of the wheel shops.

Paragraph 354—Boring Mill Practice

Twenty-two wheel shops were found to have irregular jaw-bearing points, this condition being caused by prolonged wear without periodic adjustment, resulting in diagonal and eccentric boring, irregular mounting and gauge, undue axle service stresses, wheel service losses, hot journal causes, and roller-bearing chipping or inner race breakage. Conditions of this type can be corrected by the use of the checking ring and grinding jig as manufactured by the *Consolidated Machinery* and the Niles boring jigs.

Paragraph 355—Axle Lathe Practices

Thirty-two wheel shops were found non-conforming in the machining of new axles. Among the irregularities involved were the improper location of the wheel seats or the incorrect linear location; over-length seat, a result of excessive cutting beyond the standard wheel seat end, an economic factor consuming labor, machine effort and tools, and deficient seat length, a result of excessive continuation cutting of the dust-guard seat, involving time, material and tools.

Short seats were found. This is a potential hazard frequently permitting wheels to be mounted into rear seat fillets, a cause of wheel breakage and loose wheels. Insufficient clearance between hub and fillet has resulted, defeating any attempt to measure the wheel-seat diameter after mounting and also making it difficult for inspection of loose wheels. To correct irregularities as found, a sliding gauge to locate the wheel seat from the center of the axle should be available at all shops where axles are machined.

Thirty violations were found of burrs being permitted to remain around axle center holes. Live centers on the axle and burnishing machines will completely eliminate this complaint. However, where machines are equipped with dead centers, proper lubricants should be used and the centers filed after the machining of axles.

Forty-four cases of the standard journal collar height not being maintained were reported. Proper gauges for the various axle sizes will eliminate the necessity of calipering and also save machining time.

Thirty-four shops had axle wheel-seat irregularities. It is poor practice to keep machines in operation with excessive tapers. Time and material wasted would more than justify the expense of having the machines repaired or replaced. Inferior quality of work may also result in serious derailments. Existing conditions of this type are the most costly and dangerous in axle machining.

Thirty-six shops remounted wheels on wheel seats not machined. This practice is probably general in small outlying points where the demand on the shop is greater than the facilities provided.

The proper planning of the output of shops and the machining requirements of all operations will eliminate the possibilities of these recurrences.

Paragraph 356—Wheel-Press Practice

The most numerous exceptions taken in connection with wheel-press recording tape diagrams were 40 cases where irregular diagrams were passed as satisfactory which showed over maximum and under minimum forces, some serious in extent. Needless to say, the mounting record tape should be diligently inspected by the wheel-shop supervisor, even if he does nothing else. The mounting press operators should be thoroughly trained to reject those wheels which do not pull the proper tonnage, and gauges on the press should be checked at frequent intervals for accuracy.

Twenty cases were noted where the identification mark-

ing on the tape was incomplete, making any analyses useless. This is the result of carelessness on the part of the operator.

Forty-four cases of off-center and out-of-gauge mounting of wheels, were noted, involving lack of competent gauging, checking, etc. Thirty-two cases were reported where no method was provided for the master checking of gauges and twenty-three cases where non-standard mounting gauges were in use. All gauges should be forwarded to a central point periodically for checking with master gauges.

Paragraph 363—General

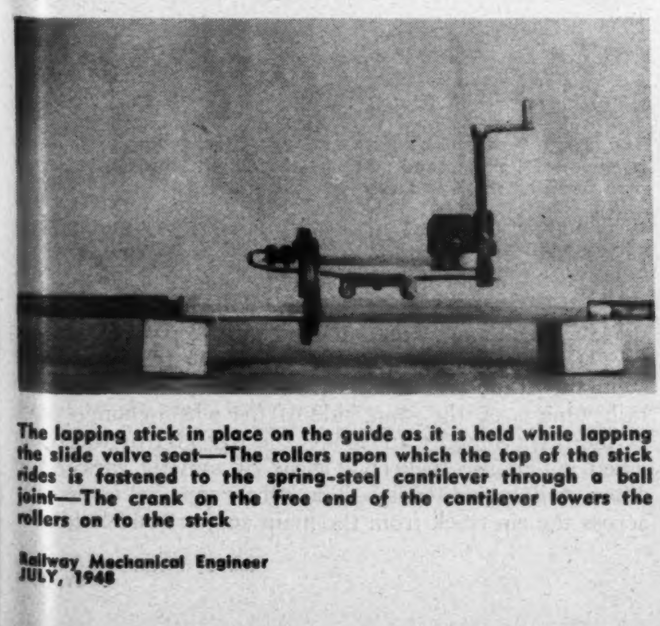
It is surprising to note that at 111 points checked, mounted wheels were stored on tracks which had non-standard double-gauge spacing, thereby causing axle surface indentations. It is certainly the responsibility of the supervisor to endeavor to obtain the standard storage tracks and the responsibility of the railroad management to see that they are provided. The expense of providing proper storage tracks would be amortized by the savings in axle maintenance and standard double-gauge storage tracks would require smaller areas for storage.

Seventy-five cases of irregular and improper loading of mounted wheels on cars were noted leading to axle damage. The use of wheel cradle cars for this purpose not only eliminates damage to axles but also results in large savings in the labor of loading and unloading wheels.

While it is true that many of us were offenders in the violations as found by the mechanical inspectors of the Association of American Railroads, I am sure that most of us have corrected the conditions where possible.

Lapping AB Slide Valves

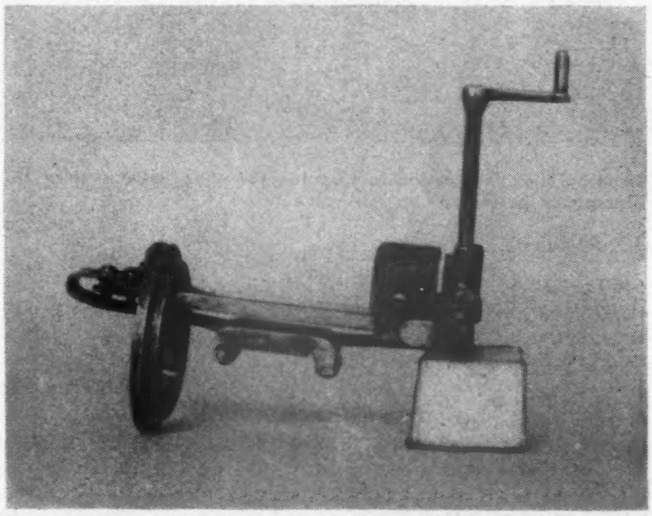
An arrangement for lapping the slide valve seats in the service and emergency portions of AB brake valves and various other flat valve seats to an accurate flat surface has been devised by the Missouri-Kansas-Texas and is standard practice in their Parsons, Kan., shops. With the lapping device the average mechanic can produce a straight level surface with virtually no risk of rounded ends or sides in the finished seat. Various modifications of the arrangement for flat lapping AB slide valve seats have been developed for the graduating valve on K and AB brakes; the equalizing slide valve of the distributing valve of 6E, 6K and 6KA locomotive brake equipment; and the equalizing slide valve, the release slide valve and the emergency slide valve of the passenger-equipment universal valve.



The lapping stick in place on the guide as it is held while lapping the slide valve seat—The rollers upon which the top of the stick rides is fastened to the spring-steel cantilever through a ball joint—The crank on the free end of the cantilever lowers the rollers on to the stick

All of the above flat valve seats are lapped with a length of block tin about 9½ in. long that is dovetailed into a section of steel of the same width but an inch or so longer. The width of the tin and the steel varies with the different valve seats; it is the minimum amount narrower than the valve seat that will permit adequate clearance for the lapping stroke. Handles are fitted on both ends of the steel-backed block-tin lapping stick, and the steel is ground parallel to the tin lapping surface.

The steel-and-tin lapping stick is restrained to a straight horizontal movement by a two-piece guide which clamps in the slide valve bushing. The guide has a spring-steel cantilever member to which a double-roller piece is attached through a ball joint. One end of the spring steel is free and the other end is rigidly fastened to the circular, step-size member of the guide which fits snugly in the brake valve counterbore. The free end is depressed by

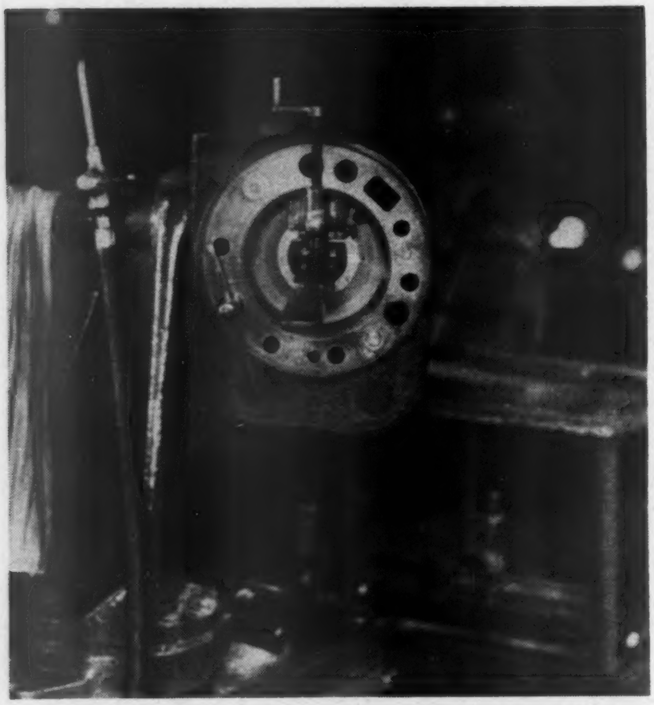


The guide for restraining the lapping stick to straight horizontal motion—The step-size circular members fits in the counterbore of the brake valve—It is keyhole shaped on the inside and the lapping stick fits through the rectangular-shaped bottom portion

a ⅜-in. bolt with a small crank on top. When the spring steel is depressed, it brings the two rollers which are spaced about two inches apart, into contact with the ground steel back of the lapping stick. The crank is tightened until the rollers press upon the steel with sufficient force to prevent wobble of the lapping stick. The total thickness of the tin and steel in the lapping stick is such that the two guide rollers are horizontally aligned with each other when the force is sufficient to guide the lapping stick. It is this holding force on the top of the lapping stick which restrains it to horizontal motion throughout the full length of the lapping stroke and prevents rounded-off ends in the slide valve seat.

The portion of the guide which comprises the step-size circular member is inserted in one end of the brake valve portion opening. The other part, which contains a spring clamp, fits over the end of a length of ¼-in. keystock which is welded to the circular member and which fits in the piston top keyway. The clamping member slips on the keystock until it engages a notch. The action of the spring catch in the notch locks the two halves of the guide together and in place in the bushing for guiding the lapping stick.

Grade FF silicon carbide and a good grade of metal polish are used as the lapping medium. The lapping stick is trued on a lapping plate 15 in. in diameter. The silicon



Lapping stick in position for lapping the slide valve seat in the emergency portion of an AB valve

carbide is sprinkled on the plate, and the lapping stick is charged with the abrasive while it is being trued. The silicon carbide imbeds itself in the soft tin. A few drops of the metal polish are then applied to the lapping stick and distributed with a clean cloth, after which the stick is blown dry. From 12 to 15 lapping strokes are then made on the valve seat, and the charging process repeated.

The subject of improved maintenance on air brake parts has been under intensive study and development on the Missouri-Kansas-Texas and will be more fully treated in a paper to be presented at the September meeting of the Air Brake Association.

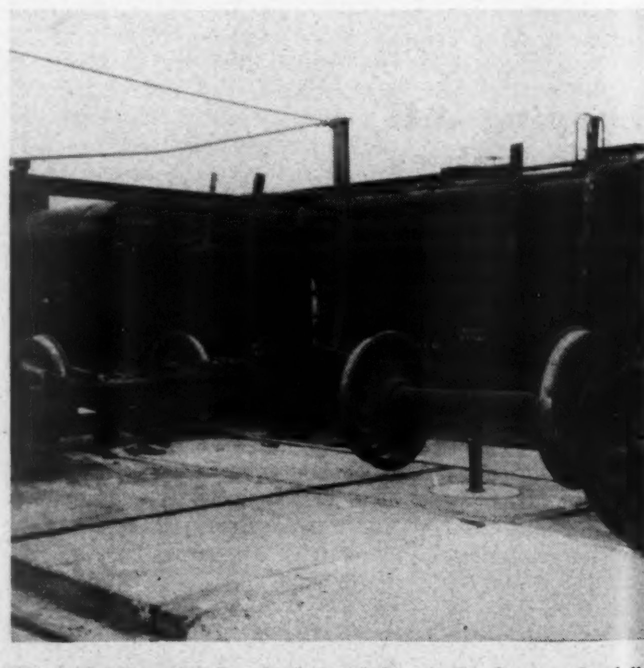
Rip Track Setup Features Rapid Wheel Change

A set of defective car wheels can be replaced in as little as 18 minutes with the layout and equipment of the Kansas City Southern's wheel-change rip track at Pittsburg, Kan. The arrangement consists essentially of a concrete work area between two sets of rails which are 20 ft. apart on centers and perpendicular to the rip track, a crane with three ratchet hoists for lifting the bolster and side frames, and two air lifts, one on each end of the work area, to raise and hold the wheel treads clear of the rip track rails to align the mounted car wheels with the perpendicular track for loading on a cart.

All cars with bad-order wheels are switched to the wheel-change rip track where they are spotted by a wire rope which is attached to the truck side frame and is moved by an electric-motor-driven winch. The car is spotted so that the truck containing the defective wheels is nearest the work area, e.g., if the front truck is defective the car is stopped a few feet before the work area and if the rear truck requires a wheel change, a few feet beyond. The end of the car is jacked up by two portable two-wheel 100-ton air jacks, and the defective truck pushed out to the concrete working area and centered under the swinging crane. Here it is dismantled and the bad-order pair of wheels rolled over the air-powered wheel lift. The bolster and side frames, which are lifted by the three crane hoists, are left in the raised position until replacement wheels are on hand and the truck ready to re-assemble. The center of the axle is placed over a saddle on the air-lift shaft extension, and the wheels are raised clear of the rails. In this position they can be turned 90 deg. with little effort. Lowering the wheels puts them on the pair of rails set at right angles to the rip track. They are rolled along this pair of rails and onto a cart on the adjoining rip track. The cart is pushed by hand down this track at the scrap-wheel dump where the wheels are rolled off on one of the several tracks that comprise the scrap wheel dump. Adjacent to the scrap wheel dump are the replacement wheel sets, also stored on rails perpendicular to the rip track. These are rolled onto the wheel cart and pushed back to the work area of the rip track, unloaded, turned on the air lift and rolled into place for re-assembly of the truck.

The three ½-ton ratchet chain hoists mounted on the swinging crane to raise the side frames and bolsters are hand-operated because the distance raised is not great and because hand operation offers close control. The bolster hoist is welded to the center of the crane boom. The side frame hoists are suspended from the beam by two-wheel trolleys which makes it possible to move them outward while supporting the side frames to get the hoist and frame clear for rolling the wheels.

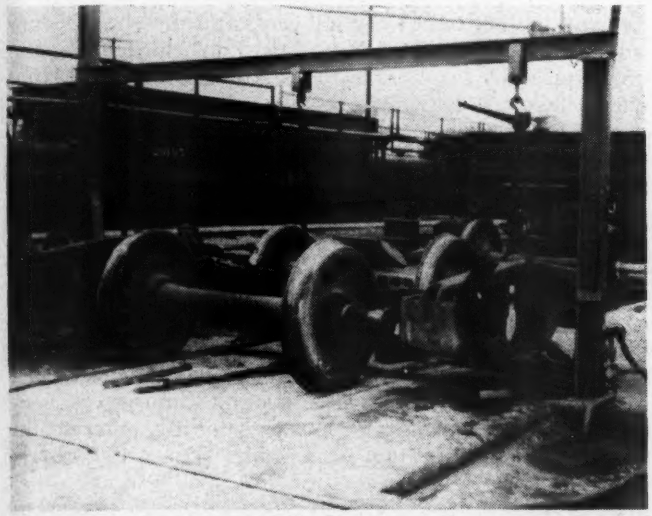
The crane is 6 ft. 1 in. above the top of the rip track rails and the swinging beam is 13 ft. across. It is made from a 5-in. I-beam and is supported across the top with a 1-in. and a 1¼-in. truss rod. It joins to the main vertical support at the pivot end through a heavy pin that fits through the round end of the opening of a U-shaped plate. The plate is welded at the open ends to the I-beam. The U-plate fits between two angles ½ in. by 3 in. by 3 in. in which holes are bored to receive the pin. There are two other vertical supports on which the free end of the swinging crane rests; both are made from 100-lb. scrap rail. One is on the same side of the wheel-change track as the pivot support and holds the free end of the boom when not in use to keep it clear of moving cars, or to allow switchers to pass. The other support is directly across the rip track from the main support and holds the



The task of turning the wheel set 90 deg. for loading on the dolly is made safe, simple and quick by the air lift which enables one man to swing the wheel set

free end while side frames or bolsters are being raised, held or lowered. Both of these supports have an inclined plate welded across the top. This is to guide the I-beam into place.

On the support holding the I-beam during use this plate is ¾ in. thick; on the other support it is ⅜ in. Both supports have a hook welded to them on the side away



After the truck has been rolled clear of the car it is dismantled with the aid of the swinging crane's three ratchet hoists—The side frames and bolster are lifted for the removal of the defective wheels and remain suspended for application to the new wheel sets

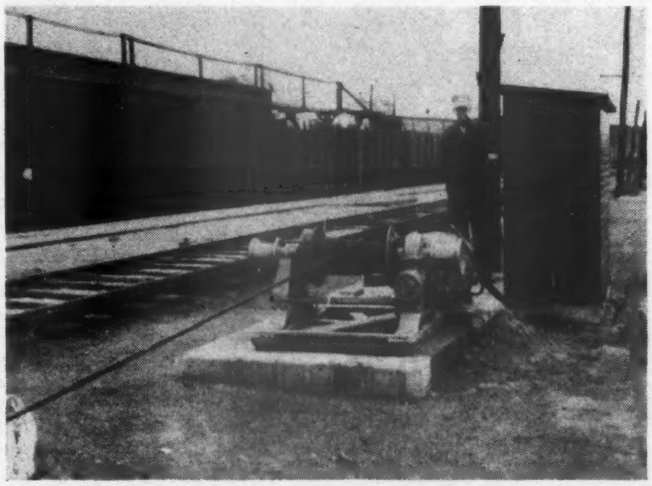
from the rip track to secure the two side-frame hoists out of the way when not in use. The side-frame hoists clamp to the truck side frames through a hook that works on the principle of ice tongs.

There is one lift for mounted car wheels on each end of the working area in the center of the square formed by the rip track rails and the perpendicular rails for rolling a pair of wheels for loading on the wheel cart. The lift consists of a 10-in. air cylinder with a hollow piston rod and a stroke of 12 in. A rod 2½ in. in diameter and 25 in. long, to the top of which has been welded a ¼-in. curved saddle plate, drops into the hollow rod. Admitting air to the cylinder raises the shaft extension and saddle into contact with the center of the axle and lifts the wheels clear of the rails. The shaft extension fits into the hollow rod with sufficient clearance to permit easy wheel turning.

The cart for hauling defective wheels away and replacement wheels to the truck holds two pairs of wheels—The track on which the cart runs is about 6 in. lower than the wheel-change rip track or the perpendicular transfer track making a straight horizontal run on to and off of the cart for the wheel set and eliminating having to lift the whels on or off the cart during loading or unloading

The cart for carrying defective wheels away from and replacement wheels to the wheel-changing area is 8 ft. long and carries two pair of wheels. It is of such a height that the wheels roll horizontally straight on to or off of the cart. The track on which the cart runs adjoins the rip track and is about 6 in. lower than both the rip track and the perpendicular transfer rails. By suspending the cart from the two axles the top of the cart rails on which the wheels are loaded is at the same level as the top of the transfer rails. The cart is carried on two sets of old maintenance-of-way car wheels. The bearings are in four steel blocks. The bottom of each block is bolted to the main frame through a filler block which is 1 in. by 3 in. by 12 in.

The bolts pass through the wheel-bearing block, the filler piece and down to the bottom flange of the channel iron that forms the longitudinal side members of the frame. The channels are welded to the front and back channels which complete the frame and which are in turn welded to the center stiffening piece, also made of channel iron. Across the three longitudinal channels two plates ¼ in. by 15 in. by 80 in. are welded. On each of these plates rests a length of bar stock 1½ in. square and 80 in. long that is welded in place. The wheels being transported rest on these two bar stocks that serve as rails and they



The winch for shifting the bad order cars on the wheel-change rip track can move up to 15 loads

are restrained from rolling off at the side by wooden wedges.

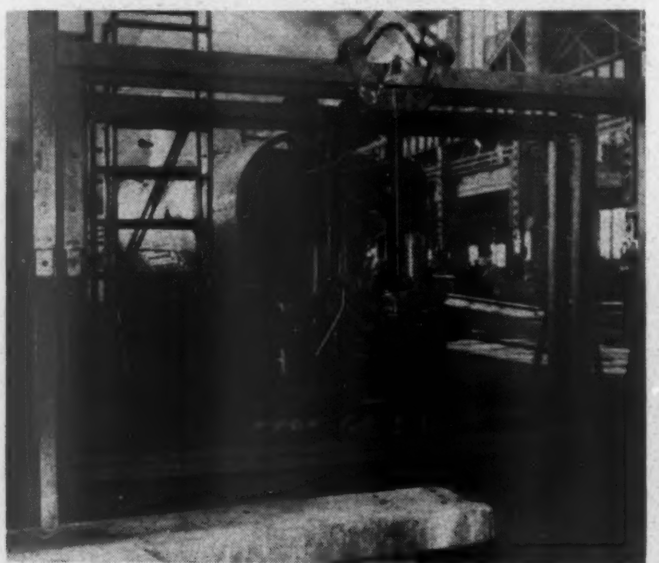
The cart is pushed at either end by a handle fabricated from 1-in. pipe. The pipe is flattened where it joins the center channel and where it fits into a slot in the filler block which holds it against the side channels.

The winch for spotting the cars is electrically driven through a worm gear and can move 15 loads at one time with the ¾-in. wire rope. A scrap car journal is installed along the winch-side of the track so that cars may be moved in either direction by the winch. The journal is set in concrete, and the hook of a sheave wheel fits in a loop attached to the journal.

The wheel change area is concrete 30 in. deep to provide a solid foundation and a good working surface. It extends for 15 ft. between the transfer tracks and between the rails of the perpendicular tracks. The cement extends 4 ft. on the side of the track with the main crane support and 8 ft. to the other adjoining track on which the wheel sets are transported. Adjoining the concrete area are two small wooden shacks in which are kept small repair parts such as brake hangers and shoes, brasses, waste, rags, nuts, bolts and cotter keys.

Holding Rack For Staybolt Drilling

A holding arrangement for air-motor drills that is adjustable vertically, horizontally or to any angle has been constructed at the Parsons, Kan., shops of the Missouri-Kansas-Texas for drilling out staybolts, drilling and tapping holes for staybolts and staybolt bushings, countersinking holes for welded flexible staybolt sleeves, and for



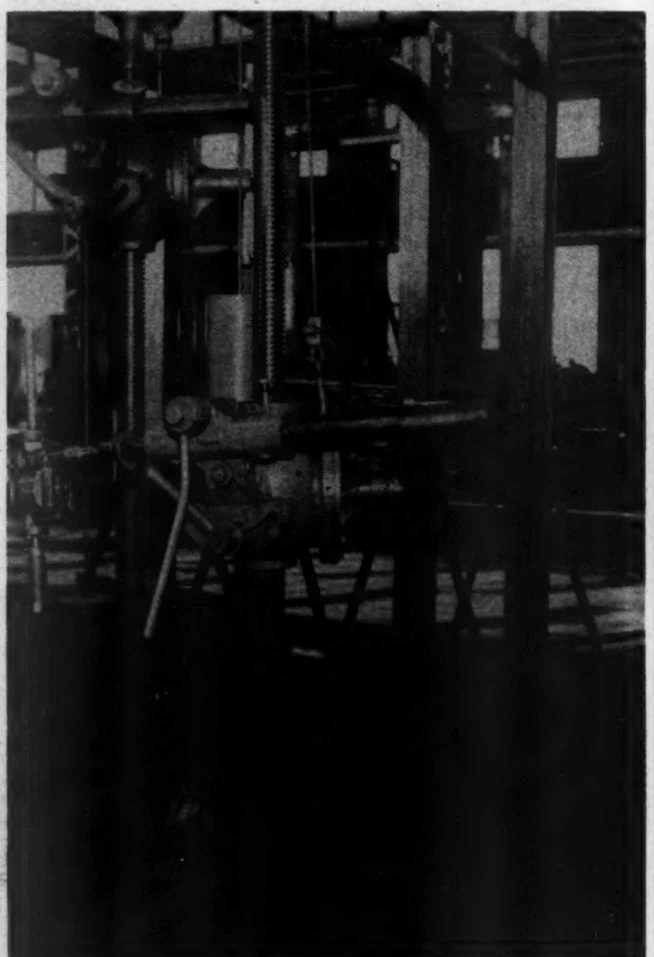
The adjustable support for holding the air motor while drilling out staybolts

cleaning the metal around holes preparatory to welding. The overall arrangement is made long enough to cover the length of the firebox and is mounted on 4-ft. flanged-end metal horses to reach the top holes. The air motor is attached to a tilting shaft and set at the desired angle for tapping or reaming; for drilling out a stapbolt it centers in the telltale hole.

The framing on which the adjustable motor support rests is constructed from scrap plate, angle and channel iron. The main bottom support is a 12-ft. length of iron 1½ in. by 6 in. set on edge with an angle 2½ in. by 2½ in. fastened to each long vertical side to stiffen the bottom member against the force developed by feeding the drill. Along the top of this member a dolly with two roller-bearing double-flanged wheels rides and carries the air-motor adjustable support. The bottom support rests on two channels 6 in. wide and 5 ft. long. These are set perpendicular to the main bottom support on each end with the flat side of the channel up. On each of the side supports two lengths of ½-in. plate 6 in. wide are bolted. The end of each length of plate that is near the center of the main bottom cross rail is bent upward, and the bottom rail rests on the extremities of the bent-up portions of the plate.

The main vertical support on each end is formed by fastening the flat sides of two 6-in. channels to the vertical portions of the ½-in. plate that extends across the bottom side supports. Between the top of the bottom cross rail and the bottom of the top cross rail the channels are separated by a wood filler block 1 in. thick. The top cross rail is 1¼ in. by 6 in. It is stiffened by two 2½-in. angles fastened to it on one side, the free sides of the angles touching each other to form a tee-shape. Two double-flange wheels fit the under side of the top cross rail to hold the top of the adjustable motor support in place.

The motor support is raised and lowered on a 3-in. vertical shaft which has worm-gear threads and two slots ¾ in. wide by ⅜ in. deep to prevent the support from turning. Lifting and lowering is accomplished by turning a crank on a stub shaft which moves the housing up and down on the worm gear through a gear train within the housing. The weight of the housing is neutralized during raising and lowering by a counterweight suspended from one end of a cable. The other end is



Group of holding racks for drilling, tapping and countersinking holes at any angle or location in the firebox

attached to the housing, and the cable runs over a pulley mounted on the top motor-support dolly.

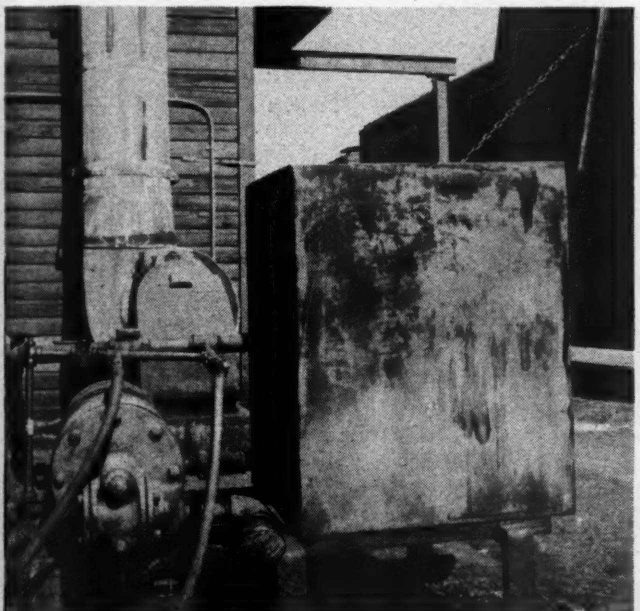
The housing is tilted to the angularity of the hole being drilled, reamed or tapped by pivoting about a shaft. It is locked in place at the desired angle by a small nut with an integral handle that fits in a quadrant slot. The

support is moved horizontally by hand; it is held where moved by the back thrust from the feed.

Feed screws are removed from the air motors used in conjunction with the drilling racks, and the feeding is done by a rack and pinion on the tilting shaft. The tilting shaft is fed by a long handle attached to the pinion shaft. The motor fastens to this feed shaft through an adapter which takes the place of the feed screw. The adapter has a jam nut to prevent over tightening from the motor torque and is slotted to accommodate a drift for knocking out drills.

Filter Cleaner

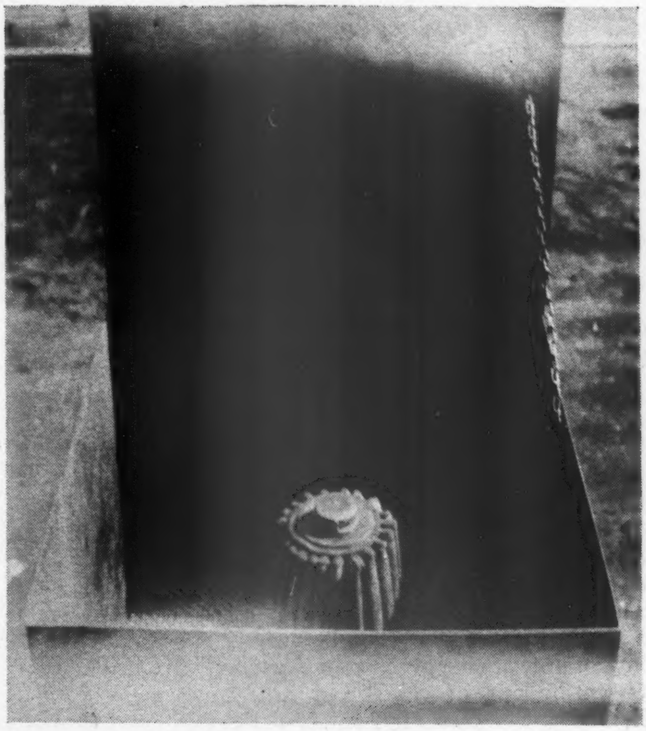
Circular filters are effectively cleaned in about twenty minutes at the Omaha shops of the Union Pacific with the aid of cleaning and drying equipment constructed by the shop forces. The filter is placed over a length of 2-in. pipe perforated with 1/8-in. holes, and a mixture of air and mineral spirits is forced through the filter from the inside outward by a scrap locomotive air compressor. Upon completion of the cleaning operation the filter



The pump and the cleaning enclosure for cleaning and drying circular filters

is centrifugally dried within a separately located circular enclosure.

The cleaning function operates on a closed cycle; the spirits forced through the perforated pipe and the filter drain back to a reservoir through a layer of cotton waste which is held between two metal screens and covers the entire cross section of the enclosure. The cleaning fluid is restrained from escaping to the atmosphere and being wasted by housing the filter undergoing cleaning in a sheet-metal enclosure 30 in. square by 36 in. high. The enclosure has a hinged cover that is closed during cleaning but opened for the insertion and removal of filters. The reservoir is in the bottom of this enclosure, and is connected to the pump by the inlet pipe to the liquid cylinder of the pump. The outlet pipe from this cylinder connects to the perforated pipe on which the filter is mounted. While being cleaned, the filter is held in place with a 2-in. pipe cap screwed hand-tight on the top threaded portion of the perforated pipe.



Inside of the enclosure in which the filters are cleaned by being placed over a perforated pipe through which a mixture of air and mineral spirits is forced

The centrifugal drier is revolved by an old Worthington centrifugal feed-water pump operated by air. The filter slips over the extended pump shaft and is held in place by a plate which is secured with a nut drawn wrench tight on the threaded end of the shaft. It is prevented from flying apart by a wire mesh cover which fits over and around the cylindrical surface. Two air lines are used for the drying. One goes to the pump to drive it and the other supplies air to two pipes, one of which is located along each side of the rotating filter inside the cover; both are perforated and blow streams of air on the filter as it is being spun. The entire assembly is housed within a metal cylinder open at one end. This cylinder serves to collect the drops of mineral spirits as they fly outward during the spinning of the filter and to drain the liquid into a container.

A filter mounted in the centrifugal dryer showing the wire mesh cover that protects the filter from centrifugal force during spinning and the manner of securing the filter to the shaft—The two pipes just above the center of the circular enclosure are perforated and blow air across the filters while they are being spun—Immediately on the left of the dryer is a typical filter before cleaning, and to the left of the dirty filter is one which has just been cleaned and dried

Questions and Answers on Locomotive Practice

By George M. Davies

(This column will answer the questions of our readers on any phase of locomotive construction, shop repairs, or terminal handling, except those pertaining to the boiler. Questions should bear the name and address o fthe writer, whose identity will not be disclosed without permission to do so.)

Injector Operating Water Temperatures

Q.—What temperature of feed water can be handled by an injector? Under what conditions is the steam from the injector passed back into the tank?—K. J. R.

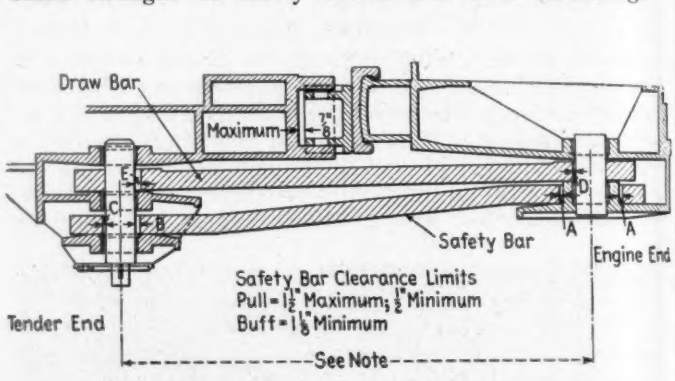
A.—The maximum temperature that can be handled by the conventional injector averages from 120 to 140 deg. F. at sea level. The temperature of the feed water that can be handled does not vary to any great extent with the steam pressure used. When an injector is operating with comparatively cool water in the tank a partial vacuum exists in the overflow chamber which is normally closed off from the atmosphere by an overflow valve held against its seat by its own weight and the vacuum underneath it. If, for any reason, the injector should "break" when operating in this manner, the overflow valve will immediately be opened and the water and steam blown out on the ground until conditions permit the injector to restart or until it is restarted by the operator.

On the other hand, when hot tank water is encountered a pressure exists in the overflow chambers, and to prevent spilling at the overflow under these conditions pressure must be applied to the overflow valve to hold it against its seat. On a conventional injector the provision is made to screw down the overflow valve to take care of this condition. With the overflow screwed down manually the injector will handle hot water. However, should the injector "break," the steam instead of blowing on the ground will be blown back into the tank hose and tender. While usually a tell-tale is provided in the cab to warn the engineman of this condition, damage may already have been done to the tank hose before the injector can be shut off. The steam blown back into the tank may heat the water to the point where it is too hot to be picked up again by the injector.

Safety Bars

Q.—The I.C.C. rules state that, "Two or more safety bars or safety chains of ample strength shall be provided between locomotive and tender, maintained in safe and suitable condition for service, and inspected at the same time the drawgear is inspected." What is considered ample strength for safety bars or safety chains? Is it permissible to use a single safety bar in conjunction with the draw bar?—F.J.K.

A.—Ample strength for safety chains or safety bars means sufficient strength to prevent separation of the locomotive and tender if the drawbar fails. The combined strength of safety chains and their fastenings



Note: Clearances shown should exist as locomotive leaves shop. As the drawbar wears, the safety bar clearance (A+C) will reduce, but the clearance (A+C) must not be less than ½ in. Such a condition should be corrected by either lengthening the safety bar, shortening the drawbar or applying a new drawbar. Maximum clearance (A+C) is 1½ in.

Application for drawbar and safety bar

should not be less than 50 per cent of the strength of the drawbar and its connections.

Single safety bars are used in conjunction with the drawbars on modern locomotives. The drawbar and safety bar are placed one above the other, the engine and tender bed drawbar pocket being designed to include the application of the safety bar, using the drawbar pins for holding both the drawbar and the safety bar as shown in the accompanying illustration.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Fire-Cracked Tubes

Q.—We have considerable trouble with boiler tubes and flues cracking longitudinally and also at the tube sheets. We repair them by welding. I would appreciate any information as to the manner of repairs being made on other roads.—E.A.C.

A.—A summary of the replies to a questionaire sent out to the railroads by the Master Boiler Makers' Association on this subject is as follows: Methods used in making repairs to cracks: The welding of "fatigue metal," which is the condition of a fire-cracked tube, is a matter of expediency and will only prolong the life of the tube or flue for a short time. It is better to leave slight cracks alone as long as possible. These slightly cracked tubes will generally give an additional year or more of service without any trouble resulting or requiring attention. Oftentimes a light rolling or beading will close the cracks up and give no further trouble for some considerable time. For general guidance we would suggest where cracks are fine and do not enter very far into the tube or flue that they be left alone. If they leak, even slightly, either roll or bead to close up the cracks. If this is not satisfactory vee out crack and weld.

The following are reported by some railroads as being

successful methods used by them to repair longitudinal cracks: (1)—"Chipping off old weld, re-rolling flues and drawing the cracks together with a blunt beading tool, and re-welding; (2)—"Chip welds off beads, prosser, rebead, and re-weld to prolong life of flues; (3)—"Chip crack out and electric weld. If several cracks are close together we cut the defective portion of bead off and build up with electric arc welding; (4)—"When cracks develop to the extent that they are likely to leak before the next monthly inspection, the weld adjacent to the bead where the cracks are located is chipped off; the bead is re-worked with a beading tool and the bead is then re-welded and the flue is then rolled slightly, and (5)—When cracks start to develop longitudinally at fire end of the flues, the flues are re-worked with a special ground-out expander to remove the scale from the water side of flue and flue sheet, and the material is by this action slightly expanded. Should this method of repair not improve the conditions materially, the welded beads are removed and flues re-worked and re-welded. This method usually prolongs the life of flues from 25 to 40 per cent of the miles on locomotives involved.

"In the questionaire which was sent out upon this topic, from which we received replies from 40 American and Canadian railroads, there was this question: "What successful methods have you used in making repairs to cracks?" The analysis of replies received is as follows: 60 per cent make repairs along the general lines quoted above; 17.5 per cent do not make any attempt to repair cracked tubes and flues, the defective tubes and flues are removed, safe-ended and re-applied; 15 per cent claim they do not experience this fire-cracking of tubes and flues, therefore, no repairs are necessary, and 7.5 per cent state they have not found any successful methods of repairing longitudinal cracks of tubes and flues."

Welt-Strap Rivet Spacing

Q.—In laying out welt straps for longitudinal seams when applying new and half shell courses, is there any method of determining the circumferential spacing of the rivets on the flat welt straps so that when they are rolled the rivet holes will match the holes in the shell on both the inside and outside welt straps.—W.A.D.

A.—The width of the welt strips is determined from the sum of the combined spaces between the longitudinal rows of rivets. The dimensions for these spaces are not the same as the plate dimensions given on the plate-development and seam drawings, but are proportional to the neutral diameter of the boiler and the welt strips. The spaces between the rivet rows will be increased over the plate dimensions for the outside-welt and decreased for the inside-welt strip. These dimensions may be found by laying out a cross section of the shell or by calculation.

The dimensions can be derived by the use of the proportional method as follows:

Then

$$R : A = R^1 : X, \quad X = \frac{R^1 A}{R}$$

Where,

R = Neutral radius of shell
R^1 = Neutral radius of welt strip
A = Space between longitudinal rivet rows (shell)
X = Space between longitudinal rivet rows (welt)

Air Brake Questions and Answers

The 24 RL Brake Equipment for Diesel-Electric Locomotives—Parts of the Equipment—Locomotive A Unit

Operation of the Equipment
Safety Control System

695—*Q.—What happens then?* A.—Air from chamber *A* lifts supply valve *8* and flows to chamber *B*.

696—*Q.—Where does the air flow from chamber* B? A.—To passage *3* to pipe *3* to the diaphragm foot valve.

697—*Q.—With the foot pedal released, what happens?* A.—With the foot pedal released, diaphragm *6* is off its seat, the air flows past diaphragm to pipe *3* and passage *3* in the brake valve to the chamber on top of exhaust valve *351*.

698—*Q.—With the handle depressed, what happens?* A.—The exhaust valve is seated, therefore, the safety control system and chamber *B*, on top of the service application piston *112* are thus charged to main reservoir pressure, and the piston is moved downward to release position.

699—*Q.—With both foot pedal and brake valve handle released, what happens?* A.—A safety control application is initiated.

700—*Q.—Explain what happens.* A.—Air from chamber *B* above application piston is vented through passage *10*, pipe *10*, chamber *A* in the H-24-D relayair valve unit, chamber *B* in this unit passage *3*, pipe *3*, to the diaphgram foot valve, past diaphragm *6*, pipe *3* to the DS-24 brake valve, passage *3* and past exhaust valve *351* to the atmosphere.

701—*Q.—With the air being vented from above the application piston what is the result?* A.—Air can not build up in chamber *B* above the piston, from chamber *A* beneath the piston due to choke *K*, therefore piston *112* is moved to its upper or application position.

702—*Q.—What is the result?* A.—In application position, the slide valve connects passage *5* from the equalizing reservoir and chamber *D* on the face of equalizing piston *77* to cavity *P* in service application slide valve *114* and passages *24* and *18*. Choke *M* in the slide valve permits reduction of equalizing reservoir pressure at a service rate, so that a service application of locomotive and train brakes results.

703—*Q.—What happens if the brake valve handle is left in running position?* A—All the air in passage *5* and equalizing reservoir is vented through passage *18* and cavity *A* in the automatic brake valve rotary to atmosphere.

704—*Q.—What happens if the brake valve handle is moved to lap position?* A.—Passage *18* is lapped by the rotary valve and the equalizing reservoir pressure equalizes with the reduction limiting reservoir and the second reduction reservoir to provide a full service applieation of the locomotive and train brakes.

D-24-A Feed Valve

705—*Q.—What supply pressure enters the feed valve and how?* A.—Main reservoir air from passage *30* enters the feed valve at chamber *A*.

Diesel Locomotive Questions and Answers

By J. R. Benedict

THE purpose of the fuel system is twofold. It supplies clean oil to the cylinder injectors for usage or for the combustion within the inside of the cylinders. It provides cooling and lubrication for injector pistons.

On the EMD Type 567 engines the fuel is transferred from a 1,200-gal. storage tank to the injectors by means of a transfer pump driven by a ¼-hp., 64-volt, 1,100-r.p.m., d.c. motor. This motor drives fuel pumps listed:

Engine	Gallons Fuel Consumption at Idle—Per Hr.	Gallons Fuel Consumption at Full Power per Hr.	Type of Pump	Pump Capacity
12 cylinder	2.5	64 at 7/16 in. power piston	One-Tuthill	2 g.p.m.
16 cylinder (1,350 hp.)	3.5	85 at 7/16 in. power piston	Two-Tuthill	2 g.p.m.
16 cylinder (1,500 hp.)	3.5	95 at ⅜ in. power piston	One-Viking	4 g.p.m.

With the above information it can be determined that, for example, on a 16-cylinder 1,350-hp. Diesel engine where two fuel pumps are used, each having a capacity of two gallons per minute, 240 gallons of fuel oil are circulated throughout the fuel system every hour. If the Diesel engine consumes a maximum of 85 gallons per hour, the remaining 155 gallons are used to lubricate and cool the injector pistons. The common troubles experienced throughout the fuel system are as follows: (1) Dirty filters and strainers, (2) air in the fuel system, (3) defective injectors, (4) defective transfer pump or pump motor, and (5) fuel oil diluting the lubricating oil.

1. *Q. How can you determine when the strainers or filters become dirty?*

A. There are one Wastex packed suction filter, one three-element pressure filter, one two-element pressure metallic strainer, and two metallic injector strainers used in the system on DF-3 locomotives. If the pressure filters and strainers become dirty, it will be indicated by fuel by-passing through the 60 lb.-100 lb. relief valves and sight-glass assemblies. On DF-3 locomotives the fuel by-passes through 45-lb. valves. If the suction filter becomes dirty, it will be indicated by a lowering of the fuel level in the 5-lb. relief valve and sight glass. The other indication of dirty filters and strainers while operating on line of road will be a laboring of the Diesel engine and intermittent vertical motion of the governor power piston shaft to an overloaded position.

2. *Q. How can it be determined that air is present in the fuel system?*

A. Air in the fuel system will be indicated by bubbles showing in the 5-lb. sight glass. To determine whether bubbles are resulting from a suction leak between the fuel tank and transfer pump, or gasses from a defective injector, stop the Diesel engine. With the Diesel engine dead, bubbles will disappear after a short interval if the trouble is a defective injector. Bubbles will remain if the trouble is a suction leak. To correct the suction leak, examine all piping from the transfer pump to the storage tank, noting carefully the suction-filter cover gasket. If trouble is in a defective injector, examine by feeling all injector intake and outlet pipes between the injector body and manifold, and the temperature variation or increased temperature of any one of the injectors will indicate a defective spray tip and check valve, allowing cylinder gasses to build up a counter pressure in the fuel system.

3. *Q. How can a defective injector be located on the engine while operating?*

A. Defective injectors are usually piston seizure, control-rack seizure, or defective spray tip and check valve. The defective spray and check valve are indicated as outlined in the above question. Injector piston seizure is located by removing the covers from the engine deck and observing the pistons of the injector which have seized. The seizure of such pistons can be located when the piston of the injector seizes at the bottom of the stroke. This can also be determined by the noise of the rocker arm striking the cam shaft without any load on the rocker arm. Injector control-rack seizure is located by disconnecting the engine lay shaft at each bank of cylinders, thus determining the bank in which the defective injector is located. The bank of cylinders with an injector control rack seized can be determined by the locking effect on a control rack; then remove micrometer-rod clevis retaining pin and move each individual injector control rack in and out until seized control rack is located. Seized control rack may also be located by shaking the micrometer rod sideways; a defective injector control rack will cause the micrometer rod to be tighter than those of normal injector control racks.

4. *Q. What action should be taken if the fuel pump will not run?*

A. Failure of a transfer pump to operate properly may be due to seized pump bearings, bad flexible coupling (Allen set screw loose or threads stripped), seized gear, or sheared shaft. If the fuel-pump electric motor fails to operate properly, check the following: fuel-pump contactors, contacts and toggle switch in the engine instrument panel, bad brushes or dirty commutator on the motor, burnt open or broken wires, or electrical coupler wires between engine instrument panel and motor may be loose. If the pump cannot be repaired, and no emergency fuel pump and motor are available, a hose can be connected from another engine fuel pump or the boiler fuel pump to operate the engine to the destination point.

5. *Q. How can fuel get into the lubricating-oil system?*

A. Fuel oil leaking into the lubricating-oil system may be located by checking for leaks at the following locations: (1) injector fuel inlet and outlet pipes at their connection to the fuel manifold and injector body; (2) injector control-rack port; (3) injector follower housing, and (4) injector filter caps.

6. *Q. Where is the emergency fuel cut-off valve and what is its function?*

A. The emergency fuel cut-off valve is located between the supply pump of the fill tank and the suction pipe to the fuel pump. It is operated by pull-rings attached to the underframe on each side of the locomotive and in the cab, which are connected to the valves by cables. Its purpose is to provide a means of stopping the fuel to the engine in case of fire or inability to stop the engine in the usual manner.

When one of these rings have been pulled out, the valve underneath the fuel tank must be reset manually to the open position before any fuel is supplied to the engine. When closed, this valve should completely stop all flow of oil from the storage tank; however, there is a possibility for the valve to be tripped and fail to seat properly, thereby permitting partial flow of oil to the engine, resulting in a "starving" fuel condition to exist in the Diesel.

7. *Q. What precautions must be taken on the fuel system during freezing weather?*

A. Adding one gallon of alcohol to every 600 gal. of fuel will prevent fuel oil from freezing.

Electricity in Transportation*

By Charles Kerr, Jr.†

The land transportation industry, of which the railroads are a major part, is fast becoming nation's recognized leader in the use of electrical equipment

Commercial land transportation fundamentally falls into two major classifications—the transportation of passengers in urban communities and the inter-city transportation of both passengers and freight. In the United States alone, this industry operates 175 million installed horsepower for the movement of its traffic. Potentially, no other single industry offers the electrical manufacturers such a broad opportunity for expansion in the use of electrical equipment.

Often fears have been expressed that new prime movers like the internal combustion engine, the steam turbine and, ultimately, the gas turbine will minimize the importance of electrical equipment to this industry. Actually, with one major exception, the exact opposite has been the case. Land transportation generally is becoming increasingly more dependent upon electricity, not only in motive power, but in those allied operations which are essential to the efficient and expeditious movement of traffic.

Figure 1 shows the extent to which electrical equipment has been adopted by this industry, together with the changes which have occurred in a 20-year period. Of even greater significance is the rapid expansion during the past 20 years, illustrated by Fig. 2. While total figures for 1947 are yet unavailable, sufficient information exists to indicate that motive power purchases alone in that year will equal all purchases during 1946. The present rate of expansion exceeds all previous experience.

Urban Transportation

Public transportation in urban centers is an essential service with problems of ever increasing perplexity. It can be supplied by the motor bus, the trolley coach, the street car or rapid transit train, often most economically by a combination of these vehicles. Excluding the motor bus, all are electrically operated. However, the fact cannot be overlooked that the motor bus has made its place in urban transit, often threatening the supremacy of the electrically operated vehicle. Looking to the future, the use of electric vehicles should be given added impetus by the rising price of liquid fuels contrasted to a more constant price of electric power.

The electrically propelled trolley coach is becoming very popular. For small and medium size cities, and for feeder lines in metropolitan centers, the trolley coach should have a promising future.

The street car represents the one conspicuous application in land transportation where electricity has decreased in usage. Two principal causes have contributed to this downward trend. The motor bus, traveling a right-of-way furnished by the taxpayers, has the advantage of a very low investment, and on lines of light traffic, may operate at a low cost. The street railway industry also was slow to meet this competition with improved equipment.

To stop this trend, the operating companies and the equipment manufacturers finally combined their efforts to produce a standard surface car with excellent riding qualities that could be produced at a reasonable price. This vehicle has restored the street car to public favor by furnishing a smoother, faster and quieter ride. It has demonstrated that the street car can definitely survive for heavy surface transportation if it will keep pace with technical developments.

For the mass movement of passenger traffic, the rapid transit system of large metropolitan centers has no parallel. Present four track lines can carry upwards of 200,000 passengers per hour, and the contemplated six track line for New York City should exceed 300,000 passengers

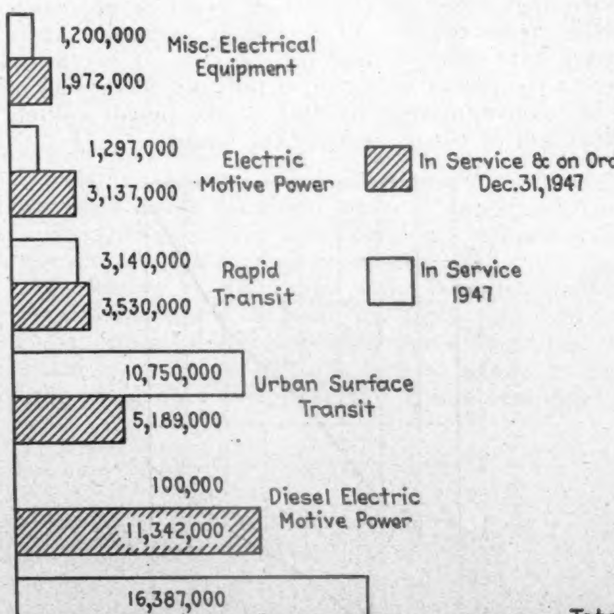


Fig. 1—Horsepower of electrical equipment used in land transportation service

*Abstract of a paper presented at the American Institute of Electrical Engineers, summer general meeting, held in Mexico City, Mexico, June 21-25, 1948.

†Consulting Transportation Engineer, Westinghouse Electric Corporation, East Pittsburgh, Pa.

per hour where over 200 trains of ten cars each may pass a given point per hour. While these systems are truly marvels of engineering, they are equally marvels of operating technique. Nowhere is reliability and safety of electrical equipment required to an equal degree. Delays of a few minutes can cause a major disruption to the life of a community.

These systems represent huge investments. Thus, the major engineering considerations in their construction are directed toward moving the maximum number of people with safety and efficiency. Without electric operation, they, and the metropolitan centers which they serve, would be an impossibility.

Suburban Operation

Suburban operations of the main line railroads are a part of the transportation service of many large cities, but are not performed by the commonly accepted local transit properties. Approximately 50 per cent of all commuting passengers in the United States are handled by electrically operated multiple unit trains.

Where congested traffic exists, the so-called multiple unit train affords a de luxe type of transportation for urban communities. It also removes many complicated operating problems. Where the traffic does not reach dense proportions, locomotive-hauled trains furnish this service. Recently, Diesel-electric locomotives have been introduced and some roads are contemplating a combination trolley-Diesel-electric locomotive. Electric drive, whether applied to a locomotive or car, gives the rapid acceleration so essential to fast schedules.

Main-Line Railroads

The uses for electricity on the main line railroads are not confined to locomotives alone, but extend to the many allied services. While motive power represents by far the largest power demands, many of the other uses for electricity are extremely interesting and represent rapidly expanding operations.

Safe, high-speed train operation would be impossible without signal systems, all electrically operated. These systems have reached their highest state of perfection where a continuous indication is provided in the cab of the locomotive, making visibility of the signals entirely independent of outside weather conditions.

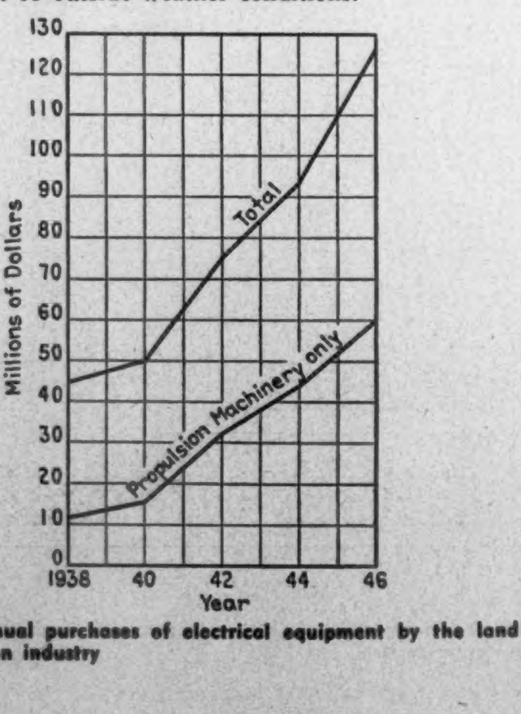


Fig. 2—Annual purchases of electrical equipment by the land transportation industry

For communication purposes, the major railroad systems maintain huge telephone and telegraph plants. But communication between fixed wayside points alone is proving to be no longer adequate for modern operation. Today, voice communication to and from moving trains is being installed, communication between moving trains, and from head to rear end of moving trains. For this type of communication, either radio or the inductive system is used.

Communication is now going even further with passenger trains carrying telephones for the use of the traveling public. Before long, you will be just as accessible to telephone service on a train as in your own home.

There are additional applications for electric machinery in wayside operations and maintenance shops too innumerable to review. One survey indicates that 150,000 motors and generators are used for such purposes by the railroads.

The electrical equipment for modern passenger cars injects many different problems in design. The power supply for most cars is provided by an axle-driven generator which must supply full load over a range in speed from 25 to 100 m.p.h. with almost perfect voltage regulation. This same generator operates with almost perfect voltage regulation. This same generator operates under the worst possible conditions and may travel from road to road, so that the reliability is essential. With air conditioning and other accommodations provided by modern cars, car generating plants range from 20 to 30 kw. each. The peak load of a 15-car train may be 300 to 400 kw., or 10 to 15 per cent of the locomotive capacity.

The many auxiliary services maintained by the railroads often are overshadowed by the tremendous concentration of power in the locomotives themselves. Those mentioned here are but a few of many, any one of which

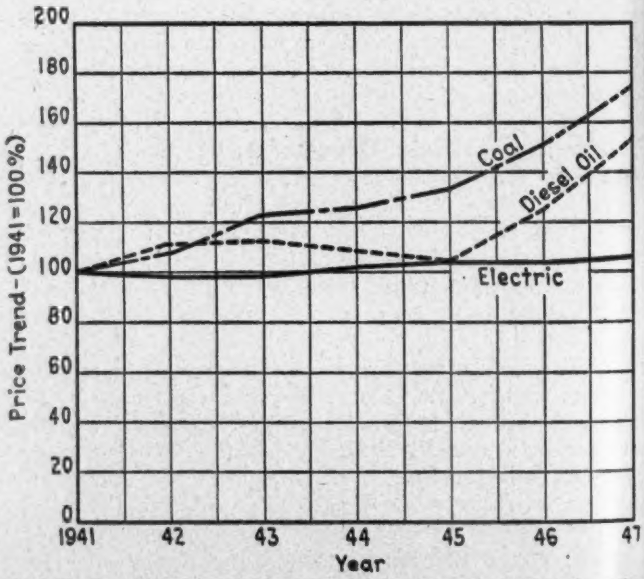


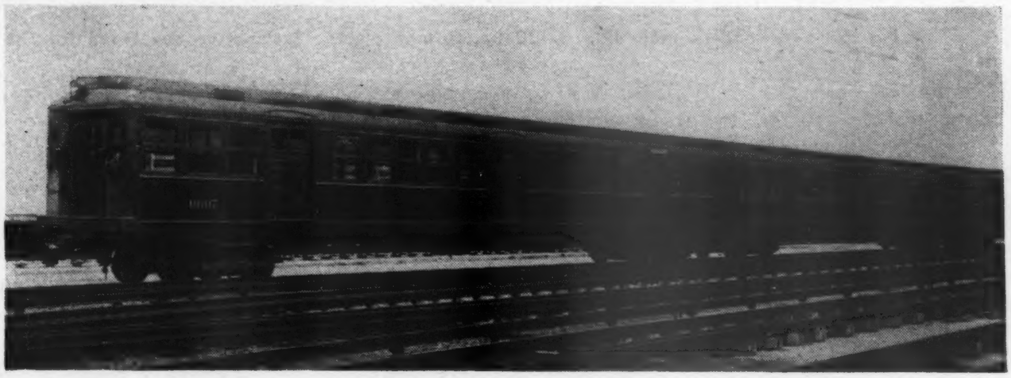
Fig. 4—Trend of electric power and fuel prices for railroad service

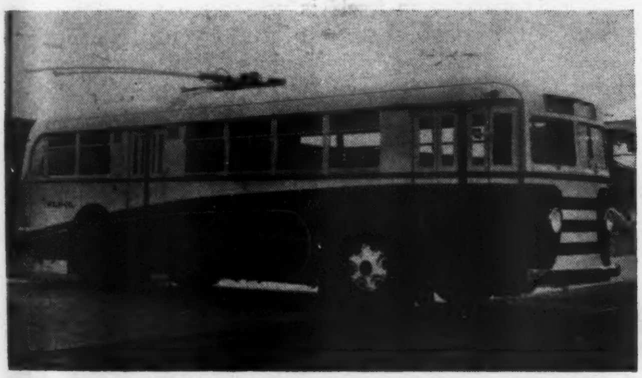
is well worthy of a separate paper. Modern transportation embraces uses for practically every type of electrical equipment, both in the generation as well as use of electric power.

Motive Power

Six types of locomotives will be available to move the main line traffic of the future reciprocating, geared turbine, turbine-electric, Diesel, gas turbine and electric. Four of these depend upon electric transmissions for traction purposes, and it is these four which are now

Fig. 3—Modern city transit equipment
(a) Surface car (above)
(b) Rapid transit train (right)
(c) Trolley coach (below)





definitely in the ascendency. If this trend should continue, all main line roads eventually may be operated by straight electrification or by electric locomotives carrying their own power plants.

Electrification

Electrification is the best means yet devised for the operation of a railroad. It has only one serious limitation—a relatively large initial investment. In spite of this handicap, more railroads are adopting or expanding its use, especially outside of the United States.

Certain conceptions regarding electrification are changing, all for the good. For many years, electrical engineers fought the so-called "Battle of the Systems", or alternating versus direct current. Today, it is appreciated that either system can solve satisfactorily any electrification problem, and the final choice is dictated by local conditions. If a generalization be possible, alternating current is usually preferable where heavy concentration of loads is encountered, while direct current proves more economical where many trains are operated with smaller individual peak demands, producing a more evenly distributed system load.

It is also better appreciated that the cost and the availability of fuels are very controlling factors in the overall economy of electrification. The prices of oil and coal are increasing while the price of electric power remains essentially stationary. This relationship in the relative prices of fuel and power, shown in Fig. 4, may exert a profound influence on the future fortunes of electrification.

The United States is blessed with a substantial supply of fuel which can be produced at a reasonable price, consequently, railroad electrification generally has been confined to those regions where traffic density dictated its use or where operating problems were encountered which could not be solved otherwise. In many other countries where fuel is not equally abundant at a low price, water power is being developed as a major source of energy, making railroad electrification an economic necessity.

As the nations of the world become more highly industrialized, rail traffic is increasing in density so that existing methods can scarcely cope with its volume. Electrification will increase the traffic capacity of these railroads at a lower first and operating cost, than that involved in laying additional track. This is particularly true where the road bed is laid with light rail, the grades are severe or narrow gauge is used.

A reduction in the capital investment required for electrification would expand its application. Greater standardization of all component parts offers the best medium for accomplishing this purpose. As an example of the possibilities along this line, a complete series of

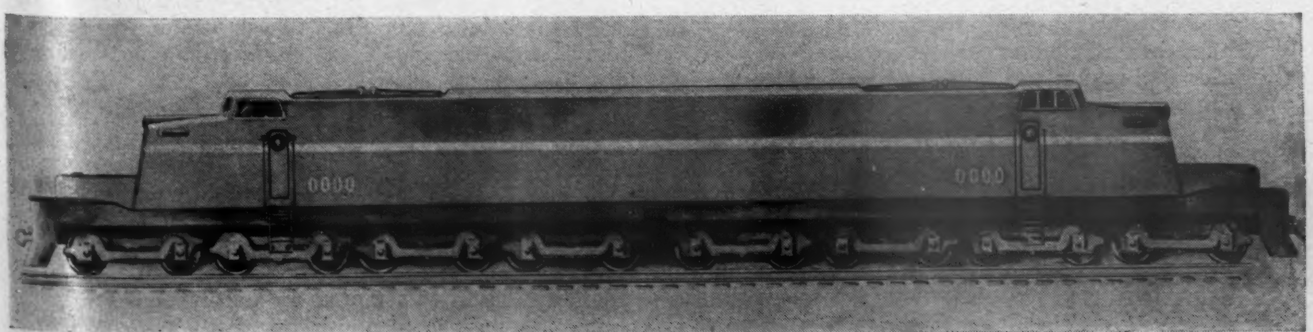


Fig. 5—7,500 continuous horsepower electric locomotive

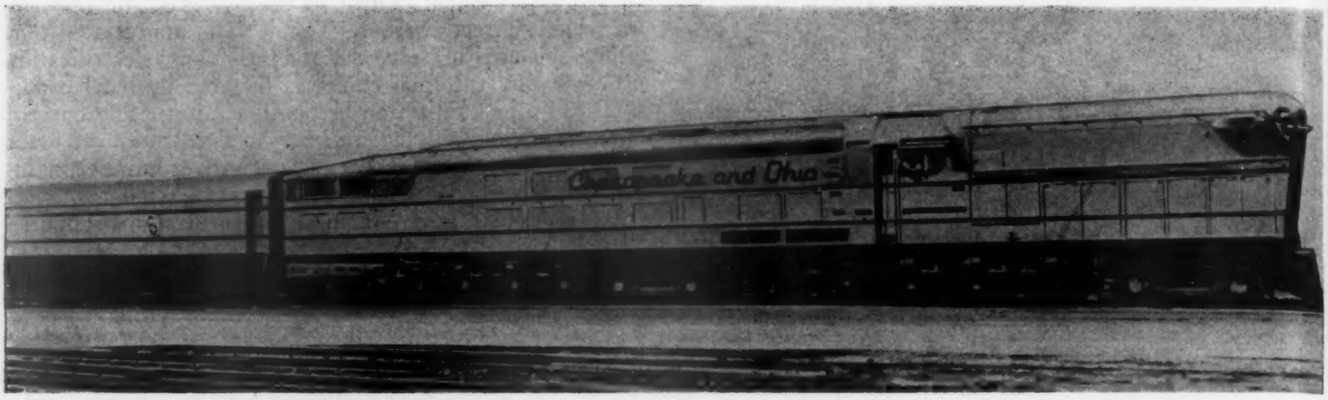


Fig. 6 (b)—Modern main line 6,000-hp. turbine electric locomotive developed for the Chesapeake & Ohio

locomotives from 1,875 to 7,500 hp. has recently been proposed, constructed from identical basic components. The same four wheel trucks and the same motor would be used on all locomotives. Only the motor gearing would be changed for passenger, freight or switching service. Many control items would be identical, differing largely in quantity used according to the locomotive capacity. A series of this kind with the proper motor is equally applicable to 3,000-volt d.c. systems or 12,000-volt a.c. systems of electrification.

A modern design of a 7,500-hp. locomotive (Fig. 5) is illustrative of electric motive power at its best. In a single unit, greater capacity is developed than three or four unit Diesels provide. All weight is carried on 16 driving axles, permitting large starting and running drawbar pull, yet imposing low axle loads on the track structure. Mechanically, it is satisfactory for speeds of 100 m.p.h. or over. Weights and clearances are acceptable to any road which can handle a standard 85-ft. passenger car. It incorporates practically every desirable feature demanded by modern motive power.

Electrification will continue to be used by the railroads of the world to a greater extent. Its rate of expansion will be determined largely by the ability of the manufacturers to reduce its first cost, by the need of the railroads to increase their traffic capacity, and by the relative price of electrical energy compared to the availability and price of other fuels.

The Diesel-Electric Locomotive

Wherever Diesel-electric locomotives are discussed, these advantages are always cited:

1. Constant rail horsepower over the normal operating range of the locomotive, providing a versatility unobtainable from the reciprocating steam locomotive.
2. A multiplicity of lightly loaded driving axles with all or most of the locomotive weight utilized for adhesive purposes.
3. Exceptionally high starting and running draw bar pull.
4. A decided increase in train tonnage.
5. Ease in the handling of heavy trains.
6. Electric braking on long descending grades.
7. Elimination of helper locomotives over ruling grades.

These desirable locomotive features are produced by the electric transmission. The same characteristics could be obtained with electric transmission from other types of power plant. It is not the purpose of this comparison to decry the many important contributions to railway operation which have been made by the Diesel engine, but to point out the significant contribution of the electrical transmission which is not too universally appreciated or understood.

Figure 7 shows why electric transmission is so important. One curve on this chart shows the ideal speed-tractive force of 4,000-hp. locomotive. This ideal curve represents a constant horsepower at all locomotive speeds, a characteristic which would secure full utilization of the locomotive's inherent capacity under every operating condition. No existing prime mover will meet this performance with direct mechanical drive. The reciprocating steam engine most closely approaches it, which accounts for its long survival in land transportation. Also shown by Fig. 7 is the typical performance of a Diesel engine with any form of direct mechanical transmission. This performance in itself is not suited to traction purposes, but through the use of the electric transmission can be converted into the ideal performance except for that loss in efficiency encountered in the drive apparatus.

The Diesel-electric has no equal for train switching service. Locomotives of 660-1,000 hp. replace steam power of considerably greater capacity. These locomotives operate for long periods without attention. Their refueling is simple, their maintenance expense is low, their efficiency is high, and their standby losses are nil. With such favorable operating expenses, they promise to replace all other types in switching service. Diesels are also rapidly extending their operating to road service. In these applications, the locomotives range from 1,500 to 6,000 hp. composed of one or more units of 1,500, 2,000 or 3,000 hp. capacity. The average size of all road locomotives is between 4,000 and 4,500 hp.

The phenomenal increase in the use of Diesel motive power is illustrated by Fig. 8. Those few railroads with electrifications have long appreciated the electric transmission and the advantages which it provides. The Diesel-electric locomotive is extending these advantages on a world wide scale.

Steam Turbine-Electric Locomotive

The coal burning steam locomotive has now adopted electric drive. In 1947, the Chesapeake & Ohio received the first coal-burning steam turbine locomotives having a rated capacity of 6,000 hp. These locomotives will haul high-speed, streamlined passenger trains on exceedingly exacting schedules.

The locomotive arrangement itself is quite novel. Coal is carried at the front end, followed by the operator's compartment. The boiler is next in line, and the turbine-generator plant at the rear. A separate tender carries water. Eight axles are equipped with traction motors.

In 1944, the Pennsylvania introduced the first geared turbine locomotive of large capacity. Experience with its operation has shown that a turbine will operate reliably and at low maintenance in locomotive service. With electric drive, the turbine should give equally satisfactory performance.

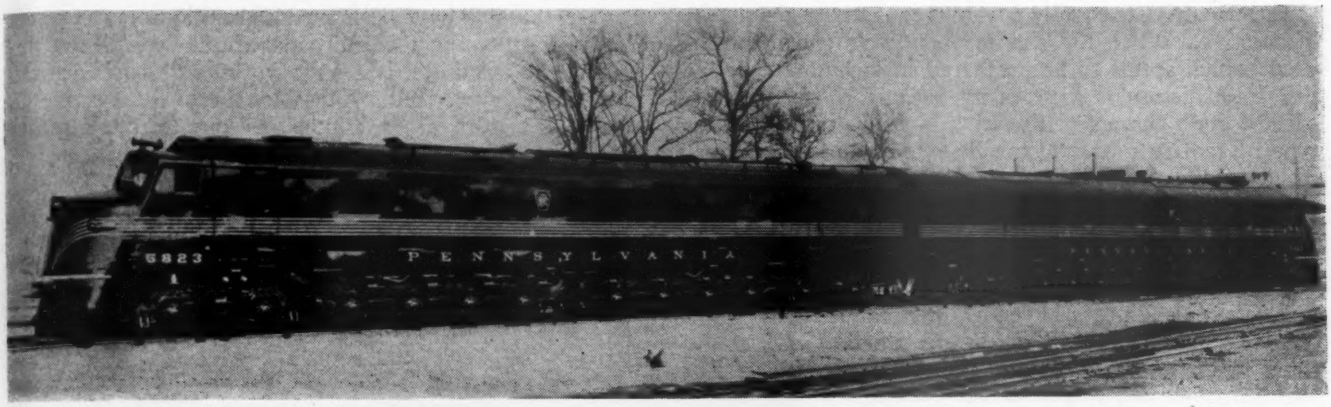


Fig. 6 (a)—Modern main line 6,000-hp. Diesel-electric locomotive in service of the Pennsylvania

In many countries, coal is the one assured, long range source of fuel. Improvement in the coal-burning locomotive to make it thoroughly competitive with the Diesel will be welcomed by roads so situated. The Chesapeake & Ohio locomotives will be watched with interest by railroad men everywhere.

A more efficient utilization of coal could be secured by the adoption of a high-pressure, high-temperature boiler. Extensive work is now under way on this problem, and if it is satisfactorily solved, the coal-burning locomotive could easily return to popular favor. The high-pressure steam locomotive, when it appears, will undoubtedly utilize a turbine-electric drive, thus, a return to favor of the steam locomotive should further increase the use of electrical equipment by the railroads.

The Gas Turbine Locomotive

From the long range viewpoint, the possibilities of the gas turbine locomotive are most attractive, including:

1. Elimination of the boiler, substituting in its place a means to utilize the products of combustion directly in the prime mover.

2. Elimination of all reciprocating machinery, substituting therefor purely rotating apparatus which, when once perfected, normally operates at low maintenance expense and for long periods without attention.

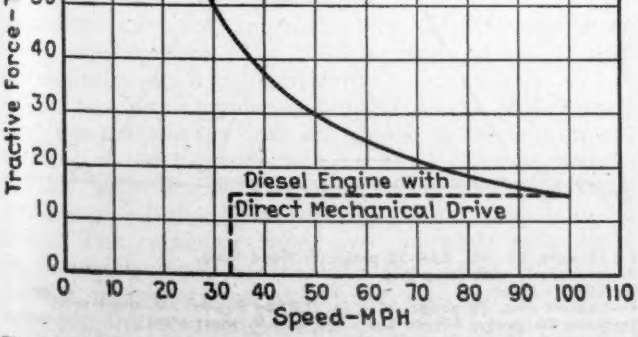


Fig. 7—Ideal 4,000-hp. locomotive performance versus Diesel engine performance

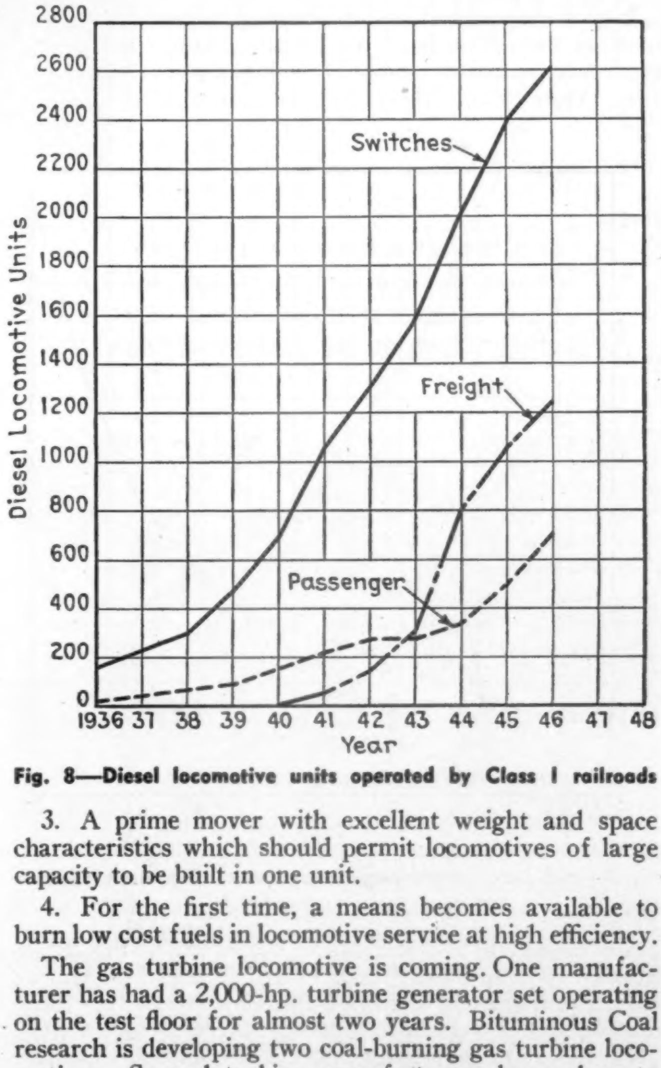


Fig. 8—Diesel locomotive units operated by Class I railroads

3. A prime mover with excellent weight and space characteristics which should permit locomotives of large capacity to be built in one unit.

4. For the first time, a means becomes available to burn low cost fuels in locomotive service at high efficiency.

The gas turbine locomotive is coming. One manufacturer has had a 2,000-hp. turbine generator set operating on the test floor for almost two years. Bituminous Coal research is developing two coal-burning gas turbine locomotives. Several turbine manufacturers have plans to equip locomotives in the near future.

Probably the first gas turbine locomotives will be oil fired. Later models will burn coal. This sequence will be dictated by the greater ease with which liquid fuels can be satisfactorily burned.

The gas turbine eventually will prove to be a strong competitor of all other types. It has so many potential advantages that its place in the transportation picture cannot be denied. But, before proved commercial units are available, extensive development will be required. At first, fuel economy will not be as good as the Diesel, but that will be compensated by lower maintenance, and will improve with further development.

Electric drive is equally advantageous to the gas turbine locomotive. When the simple open cycle gas turbine is used, which seems to be preferred in locomotive design, this transmission is a necessity because of the inherent speed-torque characteristics of this type unit. This new type of motive power also will extend, not restrict, the trend of the railroads towards the movement of traffic with electric drives.

Trends in Motive Power

Electrical engineers have dreamed for many years of the day when railroads might be electrified. Unless something halts the present trend, that day may come, with electrification consisting partly of electric locomotives receiving their power from a central power station, and predominantly from electric locomotives carrying their own power plants.

Fig. 9 shows the total horsepower of traction motors used by the railroads of the United States. Until 1936, this curve represents primarily the extension of electrification. After 1936, it represents electric and Diesel-electric

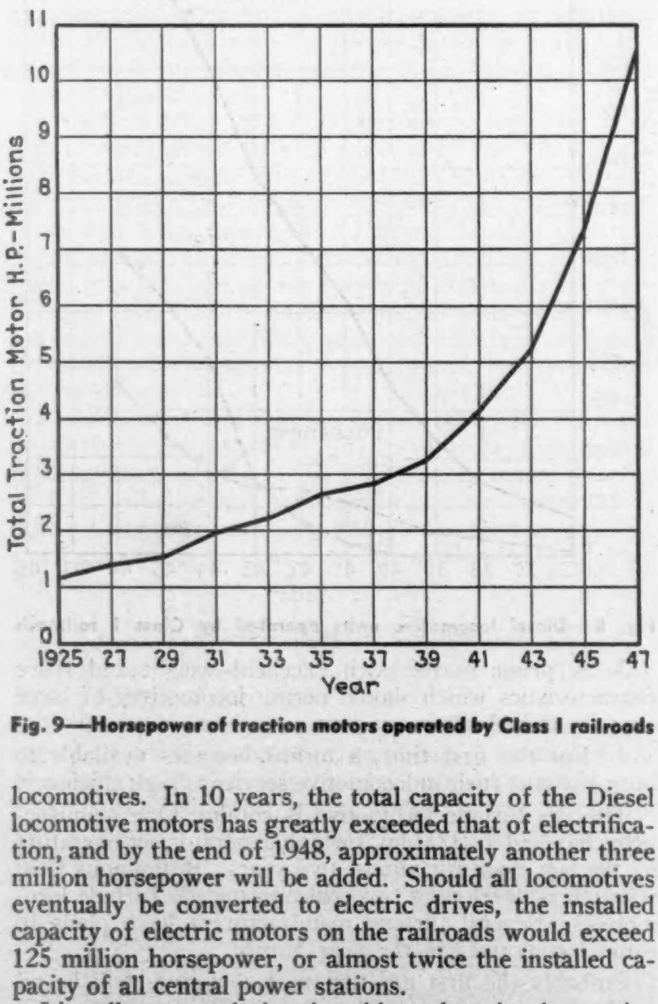


Fig. 9—Horsepower of traction motors operated by Class I railroads

locomotives. In 10 years, the total capacity of the Diesel locomotive motors has greatly exceeded that of electrification, and by the end of 1948, approximately another three million horsepower will be added. Should all locomotives eventually be converted to electric drives, the installed capacity of electric motors on the railroads would exceed 125 million horsepower, or almost twice the installed capacity of all central power stations.

Literally, a revolution is taking place in the motive power field. An interesting fact is the importance of the electric drive in this change. Its advantages have been so well demonstrated and accepted by the railroads that its position seems invulnerable to the possible vicissitudes in the fortunes of the various prime movers. Whether the railroads electrify or use steam, Diesel, or gas-turbine prime movers, their motive power will be propelled by electric traction motors to a rapidly increasing degree.

A brief summary of the uses for electricity by land transportation services has been presented for the United States. It would have been even more desirable to present similar figures for the railroads of the world, but unfortunately, accurate data on a world-wide basis are unattainable. It was felt preferable, therefore, to give an adequate picture as it applied to one country rather than a more universal picture which, of necessity, would be both inaccurate and inadequate.

The land transportation industry, with an installed capacity of 175 million horsepower, constitutes the nation's greatest user of power. In the not too distant future, with an uninterrupted continuation of present trends, this industry also will become the nation's recognized leader in the use of electrical equipment.

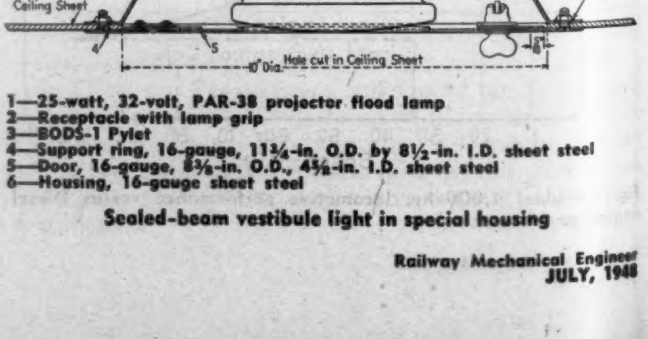
Projection Lamps For Car Platforms

The New York Central has recently installed type PAR-38 projection flood lamps for lighting platforms on some of its multiple unit cars used in its New York City commuter service. This was done because open type reflectors in this service are hard to keep clean and do not look well after several years of service. In the case of the projection type lamp, it is only necessary to wipe off one surface. These lamps are similar to the 150 watt projection flood lights now on the market for commercial lighting, except that they are only 25 watts. They were supplied by the General Electric Company.

The lamps have Edison bases and are screwed into the sockets. In some cases, it has been possible to use the original reflector housing fitted with a special cover plate and, in others, a housing as shown in the illustration is used.

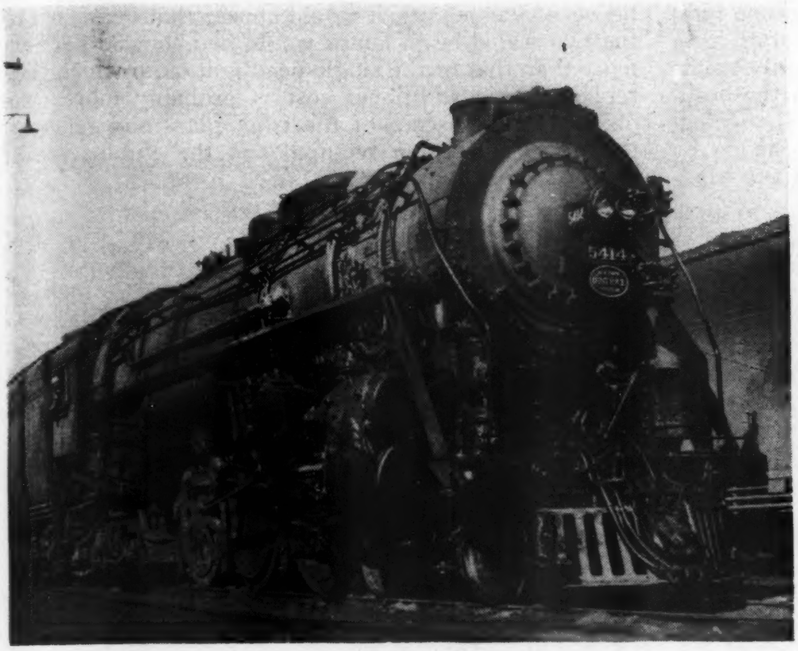
The eight screws which secure the housing to the upper surface of the ceiling sheet also hold a support ring to the lower side of the sheet. A second concentric ring, or door, is hinged to the support ring at one side and secured with a wing-nut clamp at the other. This allows for easy replacement of the lamps and also prevents their dropping down in case they should become unscrewed in the socket, since the hole in the ring has a smaller diameter than that of the lamp.

There are two lamps on each platform, 6 ft. apart, each 3 ft. from the center line of the car. The light is evenly distributed and covers the full width of the platform.



1—25-watt, 32-volt, PAR-38 projector flood lamp
2—Receptacle with lamp grip
3—BODS-1 Pylet
4—Support ring, 16-gauge, 11¾-in. O.D. by 8½-in. I.D. sheet steel
5—Door, 16-gauge, 8⅜-in. O.D., 4⅝-in. I.D. sheet steel
6—Housing, 16-gauge sheet steel

Sealed-beam vestibule light in special housing



New York Central locomotive with headlight equipped with sealed-beam lamp

Sealed-Beam Headlights

New York Central applications indicate that the sealed lamps give better performance with no increase in overall costs

The New York Central has acquired experience with sealed-beam lamps which indicates how they can be used to good advantage as locomotive headlights. The first application of sealed-beam lamps for headlights on the New York Central was made in July, 1946. Two lamps were mounted in the headlight case with the original door and reflector in place. This permitted a return to the old type lamp, if desired, with no change except the removal of the adapter plate holding the sealed-beam units.

Tests under this arrangement show that the life of the sealed-beam lamp was better than that of the standard lamp in a shock-proof socket and with the case on rubber mounts. When this was determined, a change was made to the present arrangement in October, 1947. The front door glass and reflector have been dispensed with, and a special door applied. The new door replaces the old door and has two 7-in. openings in which two sealed-beam lamps are placed side by side. The headlight case has rubber mounts as previously, but shock-proof mounts are not used for the lamps.

The two sealed-beam lamps are 200-watt, 30-volt, PAR-56 lamps, manufactured by the General Electric Company. Each lamp has three indexing bosses which insure their proper positioning with the filaments at 45 deg. to the horizontal and at 90 deg. to each other. This causes blending of the beam patterns. The beam is aligned by aligning of the headlight case, and no change is caused by replacement of the lamps. A pair of lamps produce approximately 400,000 maximum beam candlepower. The beam spreads about 12 deg. horizontally and 8 deg. vertically.

The two retaining rings which hold the sealed-beam lamps in place in the door are hinged at the bottom and secured at the top with wing nuts. Velumoid gaskets applied between the lamps and the door give a small amount of cushioning between the glass and the metal door. The retaining rings are provided with metal rings which apply pressure to the lamps through a number of springs spaced at intervals. Rubber gaskets between the retaining rings and the lamps prevent ingress of rain and dust at this point.

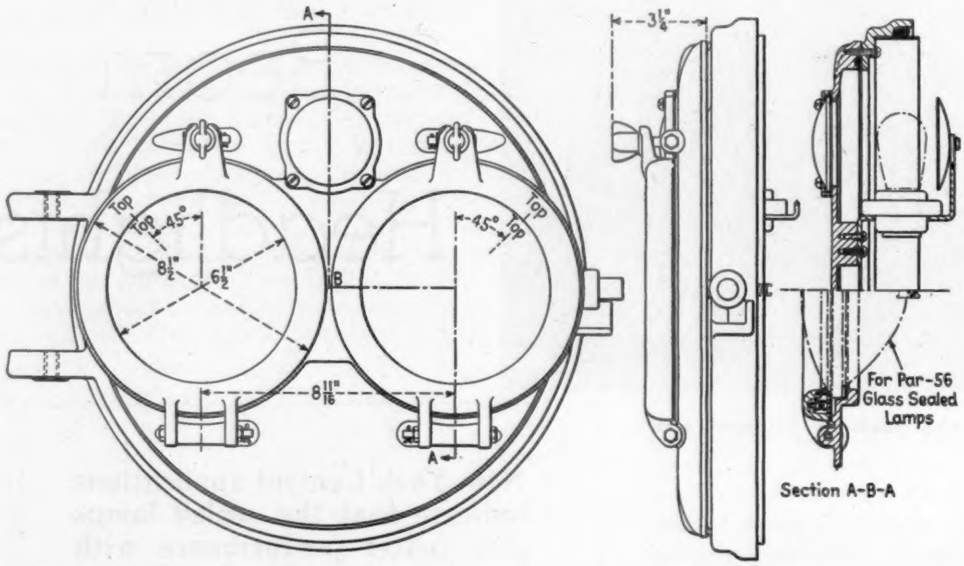
A small emergency lamp between and above the

Current practice consists of using a special door in headlight case designed originally for single headlight lamp

two sealed-beam lamps is used as a convenience light when replacing lamps. It consists of a 15-watt locomotive cab lamp, and is connected to the number-plate light circuit, since it is necessary to turn off the headlight circuit when lamps are being replaced. The sealed-beam lamps are connected to the headlight wiring by screw terminals on the lamps. The leads in the headlight wiring have soldered terminals which are also secured to the wires mechanically.

Failure of a lamp en route does not result in complete loss of light. With the old type lamp on passenger locomotives, it is the practice to change out lamps at each second washout period, or every 50 to 60 days. Operation with the sealed-beam lamps indicates that this period may be extended to six months.

The cost of a sealed-beam lamp is nearly twice that of a standard lamp. With three-times the service life between change-outs, it would appear that lamp cost of the two sealed-beam lamps would be about 30 per cent more than that of the single headlight lamp which they replace. This additional cost is probably more than offset by the absence of the front glass and reflector, the reduced cleaning required and the elimination of socket repairs.



Front and side elevations of a headlight door for sealed-beam lamps and section showing mounting arrangement of lamps

Complete new headlights designed for sealed-beam lamps are under consideration. Such headlights would be considerably smaller in size and less in weight. On Diesel-electric locomotives, it is planned to use two lamps in series on 60 volts with a switch and resistance to operate one lamp if the other fails. The headlights and special doors now in service were made by the Pyle-National Company in accordance with designs developed jointly by the manufacturer and New York Central engineers.

CONSULTING DEPARTMENT

What Causes Broken Rotor Bars

On dismantling a 20-hp. squirrel cage, three-phase induction motor for the annual overhaul, we discovered that several of the rotor bars and end rings were broken. The motor had been operating satisfactorily. What caused these breakages and how can we stop their recurrence in the future?

Vibration Is Usually the Cause

Vibration or excessive peripheral rotor speed can cause bars and end rings of a squirrel cage rotor to break. Vibration is the most usual cause of breakage and probably is in this instance. Constant vibration will cause "fatigue" and crystallization of metal, which often leads to breakage.

It is possible for centrifugal force occasioned by excessive peripheral speed to cause rotor bars to break, usually where the bars are fastened to the end rings. However, when this occurs, the chances are the broken bars will be thrown outward until they strike the stator winding, causing the motor to fail. The fact that the motor was operating when dismantled apparently eliminates this cause of the breakage.

Rotor bars loose in slots, rotor out of balance, sprung shaft and an electrically unbalanced winding can cause vibration. An unbalanced pulley, bumpy joints in a belt, and worn bearings may also cause vibration. If the bars are the least bit loose in slots, the action is cumulative. Being loose causes wear which increases the looseness.

The remedy is obvious—tighten the bars in the slots. This may sometimes be done by using slot wedges of fibre,

Can you answer the following question? Answers should be addressed: Electrical Editor, Railway Mechanical Engineer, 30 Church Street, New York 7.

What kind of care and attention is required by power transformers? Is it the same for small pole-mounted units as it is for those in vaults or on platforms?

metal or wood. After the wedges are driven in, it is a good idea to impregnate the rotor with some kind of varnish or lacquer. If there isn't sufficient space for wedges, rotor bars may be tightened by swaging them with a flat blunt-ended drift.

Unbalance is best determined by use of a machine for the purpose, but if none is available knife-edged ways will determine diametrical unbalance sufficiently for most shop motors. If the rotor is found to be unbalanced, metal may be removed from the heavy side or weight added to the light side by driving wedges in the slots.

A sprung shaft may be detected by placing the shaft, with the rotor on it, between centers in a lathe. If it is badly bent, a new shaft is the best remedy.

An electrically unbalanced winding may be caused by incorrect coil connections or too many coils cut out at one place in the stator windings. If it is factory wound, the first is improbable.

Faulty design or workmanship such as weakened places where bars are riveted or brazed to end rings will allow breakage in some instances that would not otherwise occur. This may usually be determined by inspection, noticing where and how breakage occurs. The remedy is, of course, to correct the condition. This can usually be done by brazing, being careful to re-enforce each joint by building up fillets on either side of each bar where it joins the end ring.

W. L. COTTON

Probably Incorrect Application

It is probable that the trouble with the 20-hp. motor was caused by incorrect application. Breakage of rotor bars is quite often caused by extreme heating during severe starting periods, or if the motor is stalled because of too much load or insufficient starting torque for the job to be done. Broken bars may also result from severe vibration.

The effect of broken bars is to reduce the amount of torque and might even cause the motor to fail to start after it has stopped in a certain position of the rotor with respect to the stator.

Complete details of the driven machine and complete rating of the motor would be needed to fully analyze this trouble.

C. W. FALLS,
Motor Division
Industrial Engineering Division
General Electric Company

Cause May Be Electrical or Mechanical

The breaking of rotor bars and end rings may be traced to electrical or mechanical causes or to a combination of both. While present day squirrel cage induction motors are simple and rugged in construction, adverse internal or service conditions may eventually cause the rotor to fail. The simplest method of determining whether the cause originates within the motor is to insert a similar rotor, operating satisfactorily in another stator, into the stator of the motor in question and keep it under observation. If operation is satisfactory, the rotor is at fault. If the symptoms reappear, the trouble may be in the stator or may be caused by unfavorable characteristics of the load.

Faulty Rotor: A loose squirrel cage winding in the rotor core is usually the main cause of the stated failure. The best method of anchoring the squirrel cage in the rotor core is perhaps to sandblast the rotor thoroughly clean and then dip it two or three times in baking varnish, baking thoroughly between dippings. The squirrel cage will thus be securely held in the core, vibration will be eliminated, and the cause of the failure removed.

If the rotor is not of the cast-on squirrel cage type, it may be examined for poor bar contact which may develop into broken bars or end rings. One of the easiest methods of determining poor bar contact is to energize one of the stator phase windings in series with a lamp-bank or an ammeter of suitable range from a source of low a.c. voltage. A rotor with varying bar contact resistance at different points will cause irregular fluctuations in the intensity of the lights or indication of the meter as the rotor is revolved manually. Vibration may also be caused by an out-of-round rotor or an uneven air gap.

When the squirrel cage is cracked or broken at one or more points, the electrician is faced with the problem of soldering or brazing. This repair job, however, is not always satisfactory inasmuch as it may change the branch resistance of the rotor circuit depending on the make of motor and on whether the rotor is designed with low or high resistance required by the particular application. Besides, it may be difficult in the field to properly balance such a rotor, especially when it is designed for high speed operation. It is, therefore, advisable to replace the rotor if it is too far gone.

Faulty Stator: If the trouble is traced to the stator, the winding connections, number of turns per coil, and winding pitch may be checked to see if an unequal pull around the periphery is being exerted. This condition, coupled with a partly loose squirrel cage winding, may be responsible for the breakages. Motor vibration may also be caused by an out-of-round stator bore or worn-out bearings.

Faulty Application: Overload of the motor is another point to consider. Excessive or unequal heating produced especially at spots along the end rings where the contact resistance of bars with end rings may vary, can cause an unequal distribution of secondary currents and result in a non-uniform torque. Vibration may also be induced by the type of load or method of drive. Where service conditions require frequent starting or sudden stopping or reversing under load, motors designed to withstand such treatment should be used.

R. G. CAZANJIAN

* * *

Adequate crane and hoist facilities are essential to Diesel-electric traction motor maintenance—Here a floor operated crane is shown in service in an Atlantic Coast Line shop

NEW DEVICES

Floodlights for Car Vestibules

By designing the filament of its PAR-38 flood lamp for the power supply on railway cars, the lamp department of the General Electric Company, Nela Park, Cleveland 12, Ohio, has made these flood lamps available for railway car lighting in 25 and 75-watt sizes.

Reflector floodlamp installed on a railway car platform

The 25-watt lamps for 30- and 60-volt electrical systems are intended for passageway lighting and for railway car platforms. The 75-watt lamps for 60-volt systems are intended for special use in car interiors.

Installations made thus far show that the lamp which was originally designed for outdoor floodlighting has many advantages in railway cars. They are not as subject to breakage caused by water or snow striking the lamps, while burning, as are lamps now in use.

In many cases, it will be possible merely to remove the present lamps from their sockets and replace them with the new lamps.

The PAR-38 G. E. reflector floodlamp now available in 25 and 75-watt sizes in 30 and 60-volt ratings for railway car service

These lamps have the filament and internal reflector sealed within the reflector shaped bulb with the prismatic end lens which provides a floodlight-type distribution of light.

Maintenance under dirt and dust conditions encountered in railway service is radically improved over that experienced with open-type units or ordinary types of enclosing units. The lamp can be readily cleaned, whether burning or not, by merely wiping the one end surface with a damp cloth.

These lamps are identical in size to the PAR-38 lamps that have been available on standard voltages; namely, a diameter of 4¾ in., and a maximum overall length of 5 5/16 in. Their rated life is 1,000 hrs.

Socket-Wrench Ratcheting Attachment

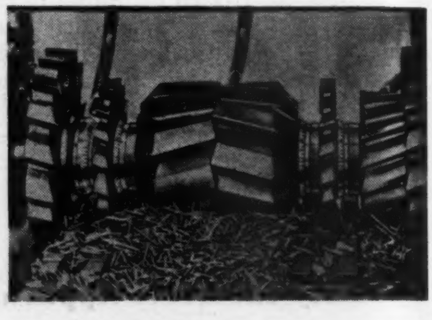
Any ½-in. drive socket-wrench handle or attachment can be converted into a ratcheting device with a tool known as the Ratchetor made by the Plomb Tool Company, Los Angeles 54, Calif. The tool has a ½-in. square plug with ball-check for holding a socket wrench, a ½-in. square opening for insertion of a handle or attachment, and a reversible ratcheting mechanism.

Plomb Tool Company ratcheting attachment for socket wrench handles

The Ratchetor is intended mainly for use with a hinge handle, a hinge handle plus extension or a speed handle or a torque wrench, but it can be used with other non-ratcheting handles. A ball-type thrust bearing and light spring tension are used to reduce back drag. The 34 ratchet teeth provide engagement every 10½ deg. The reversing lever acts directly on a pawl, eliminating a separate cam mechanism and reducing the possibility of misalignment and malfunction.

Expanding Milling Spacers

A line of expanding milling spacers for use in gang and straddle milling is manufactured by the George Scherr Company, 200 Lafayette street, New York 12. Known as the Euco micrometric expansion milling spacers, they are heat treated to a Brinell hardness of 590 and a tensile strength of 130 ton per sq. in.



Expanding milling spacers for gang and straddle milling

The fine threads used on the spacers are guaranteed to withstand any pressure used in tightening the cutters on the milling machine arbor. The spacers enable the set-up man to assemble milling cutters in any desired combination and to an accuracy of .0005 in. The spacers consist of an outer sleeve moving telescopically on a fine thread and an inner sleeve keyed to the arbor. The fine adjustment is made by turning the outer sleeve which is graduated like a micrometer, but in half thousandths of an inch.

Roller Bearing Grease

A roller-bearing lubricant has been developed by the Texas Company, 135 East Forty-second street, New York, for use on locomotive, passenger, and freight-car journals to replace liquid oils. Known as 979 Roller-bearing grease, the product is expected to increase the time between periodical inspections, and to eliminate the necessity of station-platform journal inspections on passenger equipment and intermediate-terminal yard inspections of freight-car journals and boxes. It is believed that the new lubricant can remain in service for two years or more before repacking becomes necessary.

This development is said to eliminate lubricant leakage and to form a seal against water, dirt, and wheel and

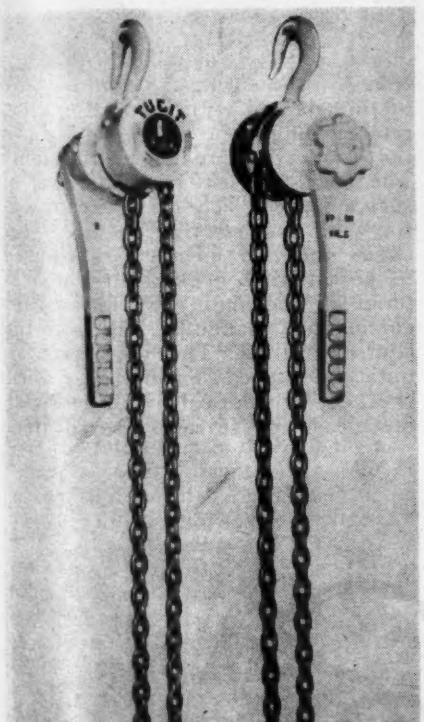
brake-shoe dust. The product protects itself from contamination. It is water resistant and will not wash out. Even at the lowest winter temperature, the starting and running torque is low and the product is toughened by chemical additives so that it withstands extreme heat and retains its lubricating powers in all kinds of weather.

The grease, which has undergone months of rigid testing in laboratories and in the field, is now being tested in fast trans-continental passenger and freight equipment.

Gear-Drive Ratchet-Lever Hoist

A ratchet hoist with an operating handle only 12 in. long for operation in close quarters and easy storage in tool boxes has been developed by the Shaw-Box Crane & Hoist Division of Manning, Maxwell & Moore, Inc., Muskegon, Mich. The tool, known as the Tugit, is equipped throughout with anti-friction bearings and will lift 2,000 lb. with a 40-lb. force on the lever. It is available in capacities of one and two tons weighing 14½ lb. and 18¾ lb., respectively.

Instead of effecting hook movement by a rachet lever acting directly on a ratchet wheel integral with the lifting sprocket or pocket wheel, lifting is effected in the Tugit by a lever acting on a gear train the same as in hand or electrically operated hoists. Interposed between the operating lever and the lifting pocket wheel is a Weston-type load brake. Because of the location of the brake, the load on it is said to be reduced below that encountered in the ordinary ratchet lever hoist.



The Tugit hoist employs a gear-train drive which permits a 12-in. handle to lift a 2,000-lb. load with a force of 40-lb. on the handle

Portable Battery Charger

A compact, heavy-duty, easily portable battery charger is now being made by the Arcway Equipment Company, Forty-ninth and Grays avenue, Philadelphia 43, Pa. It is designed for use by the railway industry for charging 16-, 25-, or 32-cell lead-acid or Edison batteries.

Its application includes charging batteries on Diesel locomotives, or on air-conditioning and car-lighting equipment either in car shops or station platforms.

The standard model A150A is rated 150 amp. continuous, weighs 450 lb. complete, including running gear, and is 19 in. high by 29 in. long by 14 in. wide. The unit comes equipped with standard railway type receptacles and a waterproof signal light.

The set includes a motor generator, receptacles and control equipment

The set charges automatically with the correct volt-ampere curve for either lead-acid, or Edison batteries. Danger of overcharging is eliminated.

All-Purpose Tool Kit

A railroad repair-shop tool kit, which, with a single tool, permits the drilling of steel, masonry and wood, the application and removal of nuts and bolts, and the driving and removal of screws, is manufactured by the Ingersoll-Rand Company, 11 Broadway, New York. In addition, the tool performs hole saw operations, tapping, reaming, wire brushing, the application and removal of studs, and the extraction of broken cap screws and studs.

The portable kit features the Ingersoll-Rand electric impact tool. Standard equipment includes the impact tool with a Jacobs collet-type chuck, six hex sockets of varying sizes, a Morse-taper socket and an adapter sleeve. A completely outfitted kit contains all standard equipment plus twist drills, reamers, taps, carbide-tipped masonry drills, hole saws, screw and stud extractors, wood bits, and wire brushes. The kit also contains screw drivers and a quick-change chuck, square Phillips and Reed and Prince bits, together with a screw-driver adapter for these bits. A universal joint and anvil extension are available.

The Ingersoll-Rand all-purpose railroad-shop tool kit

The impact tool is a Universal motor-driven, all-purpose tool. It plugs into any a.c. or d.c. electric socket and runs as any conventional electric tool until the going gets tough. Then the impact mechanism automatically functions and delivers 1,900 rotary impacts per minute to the job. With this rotary power there is said to be no kick or twist to the hand under any condition. The motor continues to run even when the spindle is stalled to eliminate motor burn-outs. Either 110- or 220-volt motors may be supplied.

The impact tool will apply and remove nuts and cap screws up to ⅜ in. thread size. It is rated for ¼-in. drilling in metal, reams up to ½ in. diameter, and handles taps from ¼ in. to ½ in. and all types of machine screws up to ⅜ in. thread. It will drive and remove studs or extract broken cap screws and studs up to ⅜ in. thread size. Various types of wire brushes with round shanks up to ⅜ in. diameter are accommodated. For woodboring, up to ⅜-in. twist drills with collet-type chuck or up to 29/32-in. drills with Morse Taper may be handled.

Metal Paste

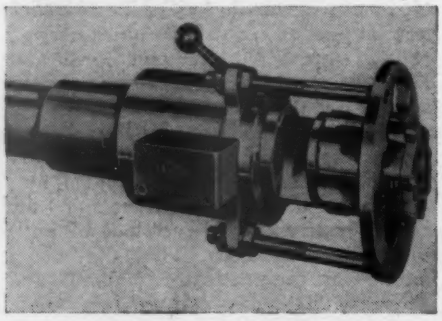
Railmetal is a putty-like product said to harden into metal for such car exterior applications as waterproofing openings around windows, doors and roofs, and for such interior use as headlining joints, filling holes for countersunk rivet and screw heads, wainscoting and partition barriers. When Railmetal is properly applied and sanded down according to directions, joints are said to be invisible.

Railmetal is all metal processed into a plastic compound containing an acid fluxing agent which etches its way into the metal surface in a manner similar to that of hot solder. It contains a bonding agent with a tensile strength of 9,000 lb. per sq. in., and is applied to bare metal surfaces with a knife or fingers. It requires no heat or flame, resists water, oil, grease, gasoline, alcohol, etc., and may be wet or dry sanded or filed within a few minutes after application. Expansion and contraction is similar to metal. When applied in a thin coating, it is flexible and may be sprayed when properly thinned with Railmetal solvent, which thins or reactivates Railmetal which has become hardened.

Railmetal and Railmetal solvent are products of Rocket Distributors, Inc., 209-14 Forty-first street, Bayside, New York.

Receding-Chaser Collapsible Taps

The Landis Style LL receding-chaser collapsible taps are designed primarily for tapping tapered threads and are



The Landis style LL receding-chaser collapsible tap

adjustable for thread length. They can be used for American tapered pipe threads or for any pipe, tubing, casing, or drill-pipe threads listed in the A.P.I. Standards if the threads are within the diametral capacity of the taps.

The receding action of the chasers is accomplished through a fulcrumed lever principle. The collapsing action of the tap causes the chasers to drop into the tap head at the completion of the thread, thus freeing the chasers from the work and permitting the direct removal of the tap without reversing it or backing out. The chasers recede into the tap head at a rate equal to the taper being produced. The head is detachable to permit the use of tap heads of various sizes and capacities on the same tap body.

Beginning with the 3-in. head, up to and including the 12-in. size, an even number of chasers is used, irregularly spaced in the circumference of the head, so that no two chasers are directly opposite each other. The taps may be used as stationary or rotary taps and can be converted readily from one type to the other. Left-hand threads can be cut by using left-hand style LM tap heads with the left-hand chip clearance and left-hand chasers.

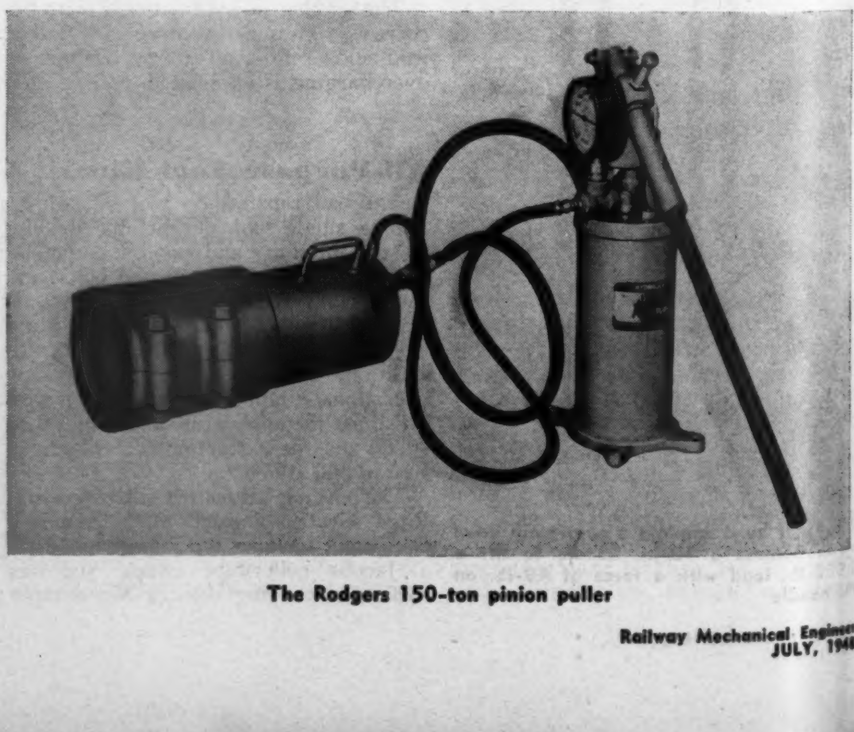
The Style LL tap body is made in four sizes to cover a range of nominal pipe sizes from 1 in. to and including 12 in. The Landis Machine Company, Waynesboro, Pa., is the manufacturer.

Traction-Motor Pinion Pullers

The Rodgers pinion puller is a hand-operated portable hydraulic unit for removing the pinions from armature shafts of Diesel-electric traction motors. Two models, one of 150-ton capacity and the other of 300-ton capacity, are available from Rodgers Hydraulic, Inc., 7401 Walker street, St. Louis Park, Minneapolis 16, Minn. When suspended in a dolly, both can be operated by one man. Pinions can be removed by means of a threaded adapter screwed into the threaded pinion in those cases where the pinions are provided with such a thread, or they may be removed by means of a clamp-on type adapter.

The complete pinion-puller unit consists of a four-speed hand pump with a gauge, a high-pressure and a return hose and globe valve, and a hydraulic cylinder of 3-in. ram travel. Either of the following threaded adapters with corresponding adapter nut is included with the 150-ton puller: 5⅞-in., 8-thread for General Electric 746, or 4⅞-in. Acme, 8-thread for Electro-Motive threaded pinions. Over-riding clamp adapters are extra and can be used with either of the above threaded adapters. The 150-ton pinion puller may be used as a complete pulling unit. When attached to the pinion to be pulled, a chain is wrapped around the motor housing, through the handle on the hydraulic cylinder, and fastened securely to prevent the puller from flying when the pinion pops loose.

The 300-ton portable pinion puller is used to remove the larger pinions on General Electric and Westinghouse equipment. This unit is produced and sold with a dolly as a part of the original equipment. It is the same type of puller as the 150-ton except for the larger cylinder and the larger and heavier dolly. A special threaded-type adapter is also available to handle any of the adapters furnished for the 150-ton pinion puller, which allows any of the pinions normally pulled by the smaller unit to be adapted to and pulled by the 300-ton unit.



The Rodgers 150-ton pinion puller

Vernier Caliper

A rustless chrome vernier caliper, which enables the mechanic and toolmaker to measure from 0 to 6 in. in thousands and sixty-fourths of an inch for outside, inside and depth dimensions, is available from the George

The George Scherr vernier caliper measures inside, outside and depth dimensions

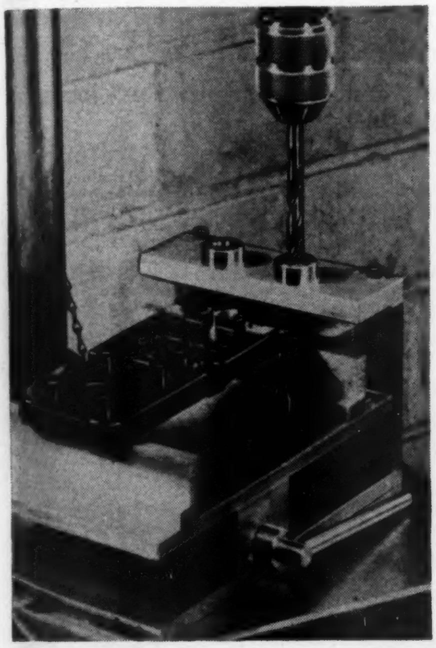
Scherr Company, 200 Lafayette street, New York 12.

The tool is equipped with knife edges for measuring the root diameter of threads and with points for accurate dividing. The blade and jaws of the tool are hardened throughout. The slide, of rustless chrome, is of such a degree of hardness in comparison with the bar that the wear between the two members is claimed to be virtually negligible. The material is thoroughly normalized to eliminate a change in size over the course of time. The jaws have an optically lapped finish and, when checked with optical flats, show that the measuring surfaces are accurate

to eight millionths of an inch. The jaws are also guaranteed to be parallel to each other.

Drill-Reamers

Drilling and reaming are performed in one continuous stroke with high-speed drill-reamers made by the Severance Tool Industries, Inc., 633 Iowa street, Saginaw, Mich. The drill-reamers are



With the Severance drill-reamer second positioning is not required for reaming

available in five standard sizes, with diameters of 3/16, 1/4, 3/8, 1/2 and 9/16 in.

The drill section of the standard Severance drill-reamers permits drilling through materials of any thickness up to that equalling the drill diameter. They also have allowance for grinding the drill point a number of times. The reamer section is designed with teeth arranged to preclude chatter and to expel the chips into the main flutes of the tool.

Severance drill-reamers are said to be best suited for short, through holes, where it is possible to complete the drilling function before the reamer section begins to finish the hole. Drill-reamers having longer-than-standard pilot drills may be had for thicker materials, and solid carbide are furnished to order when required.

Graphite Lubricants

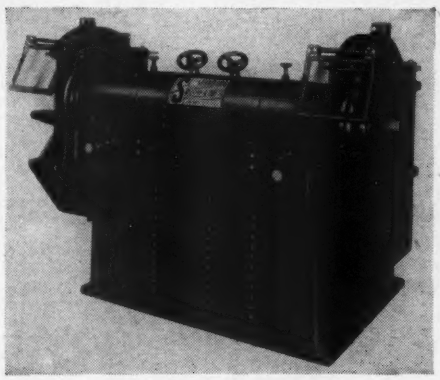
Two graphitized lubricants, known as Miracle Power and dgf-123, are produced by the AP Parts Corporation, Toledo, Ohio. Miracle Power is used in motor oils and gasolines and contains synthetic colloidal graphite suspended in light petroleum oil; dgf-123 is a concentrated dispersion of colloidal graphite in alcohol and carbon tetrachloride which provides a dry graphite pre-lubricant for application to engine parts before assembly. When used as directed, either of the two lubricants gives all metal surfaces a thin graphoid film.

Having a high attraction for oil, the colloidal graphite in the two products gives double lubrication. First, the graphoid film minimizes metal-to-metal contact by completely graphitizing all metal surfaces to insure dry lubrication in cold starts and during a temporary rupture of the oil film when the engine is operating. Second, the tendency of graphite to attract and retain oil is said to reduce oil film breakdown and lessen dry starts due to oil drainage when the engine is not operating.

Miracle Power is a pure petroleum product containing no solvents, acids, fats or alkalis, while dgf-123 is intended for use only as a pre-lubricant of parts before assembly. Immediate evaporation of the carbon tetrachloride, which is used as a carrier, leaves a pure dry graphoid film on the metal surfaces which is said to reduce engine break-in periods.

Twin-Motor Snagging Grinder

The Standard Electrical Tool Company's No. 35 twin-motor snagging grinder is a two-in-one machine with each operator entirely independent of the other. The speed is infinitely variable. One grinding wheel of the machine may be stationary while the other is operating.



Twin-motor infinitely variable-speed snagging grinder with independent controls for each wheel

One side may be operated with a wheel differing in diameter from the other side, but with each wheel operated at its correct peripheral speed.

The No. 35 grinder has two independent spindles, two 7½-hp. motors, two magnetic starters, two start-stop push-button stations, two shaft locks for use in changing wheels, two infinitely variable speed drives, two hand-wheel speed controls, and two interlocking arrangements to prevent over-speeding of the grinding wheels.

The speed control is an interlock to prevent operating the wheels in excess of the recommended speed. As the individual grinding wheel wears, the guard is adjusted. The limit stop reflects the correct spindle speed in relation to the worn-wheel diameter. A full diameter wheel cannot be mounted until the hand-wheel speed control has been reversed to its original position. This allows the wheel guard to be brought to its extreme forward position to permit clearance for the full diameter wheel.

In this product of the Standard Electrical Tool Company, 2488 River Road, Cincinnati 4, Ohio, the wheel guards are of structural plate steel, each with hinged door and adjustable to wheel wear, and the work rests are adjustable and removable.

Portable Reflectoscope

An improved, portable Supersonic Reflectoscope, Type SR05, has been announced by Sperry Products, Inc., 1505 Willow Avenue, Hoboken, N.J. Used for non-destructive testing of metals and other materials for internal defects, and for testing welds, the specifications of

Testing stud bolts for internal defects with portable Reflectoscope

the new instrument match those of the model presently in wide usage, but radical changes have been made in size, appearance and operation of the new instrument.

Elimination of waste air space, and a complete re-design of circuits are responsible for decreased weight and bulk of the new model, which is approximately 14 in. by 16 in. by 23 in. It is carried by means of handles on the case, instead of the wheeled carriage which supports the older instrument, and weighs approximately 85 lb., or about half the previous weight.

Sensitivity of the portable unit remains the same, but operation has been considerably simplified by reducing the number of external controls to five. With these controls the operator varies sensitivity, pulse width, sweep length, screen markers, and frequency. Visual indication of internal defects remains unchanged on the oscilloscope screen, but the tube is a smaller, 5-in., high-intensity type.

This model not only facilitates testing of manufactured products from raw material to finished stage, but its increased portability makes it particularly valuable for field testing of welds in tanks, pipe and various structures and for locating fatigue cracks in assembled plant equipment.

NEWS

A.A.R. Authorizes Car-Truck Research Program

Directors of the Association of American Railroads, at their regular monthly meeting in Washington, D.C., on May 28, authorized a freight-car-truck research program to be carried out under the general direction of the Mechanical Division in collaboration with truck and snubber manufacturers. As a result, the announcement predicted, "railroad freight cars will be smoother riding, faster and safer."

The program calls for laboratory and road tests of snubber devices and freight trucks designed for high-speed service. The tests will be carried on during the summer months and will consist of comparing the operation, from a safety and riding standpoint, of existing types of freight-car trucks and snubbers with new designs recently developed by the manufacturers.

The rolling laboratory of the American Steel Foundries, operated by their engineering experts and consisting of five freight cars specially equipped to test riding qualities and characteristics, will be used in the experiments. Proving ground for the road tests will be a 67½-mile stretch of track on the Illinois Central. This railroad will provide the locomotive and train crews for the operation of the test train.

Road tests of the new type freight car trucks will be conducted at speeds ranging from 65 to 90 miles an hour, with the new trucks carrying loads ranging from 60,000 to 169,000 lb.

Performance of the new truck designs will be measured by scientific recording instruments. The results will be checked by A.A.R. Mechanical Division engineers, who will act as the official observers during the tests. Following the road tests, there will be supplementary laboratory investigations.

Roads Turn In Enough Scrap for Their Steel Needs

Railroads turned back to the iron and steel industry more than a ton of scrap metal for every two tons of iron and steel they bought during the past four years, according to the Association of American Railroads. This amount of scrap, the statement added, "is enough to produce all the steel furnished to the railroads."

In 1947, railroads and railroad equipment builders obtained 6,029,000 tons of rolled steel which went into the production of new freight and passenger cars, locomotives, repair of equipment and roadway, and other purposes connected with railroad operation. At the same time, the railroads turned back to the iron and steel industry, including foundries, 3,818,000 net tons of scrap. Scrap returned by the railroads to the industry in 1946 amounted to 3,164,000 net tons compared with 4,764,000 net tons of rolled steel received. In addition, the railroads salvage and reclaim each year approximately 1,000,000 tons of worn-out and obsolete parts and materials, which, as the A.A.R. put it, "help in solving the difficult problem of distributing available steel among the many users dependent upon it."

Of the 29 million net tons of purchase scrap consumed by the iron and steel industry in 1947, railroads alone supplied

Orders and Inquiries for New Equipment Placed Since the Closing of the June Issue

Locomotive Orders

Road	No. of locos.	Type of loco.	Builder
Chicago & Eastern Illinois	15[1]	1,500-hp. Diesel-elec. frt.	Electro-Motive
	2[1]	1,500-hp. Diesel-elec. pass.	Electro-Motive
	2[1]	1,500-hp. Diesel-elec. branch-line	Electro-Motive
	2[1]	1,000-hp. Diesel-elec. switch.	Electro-Motive
Reading	15[2]	1,000-hp. Diesel-elec. switch.	Baldwin Loco.
Manistee & Northeastern	2[3]	1,000-hp. Diesel-elec. switch.	Electro-Motive
McCloud River	1[4]	1,500-hp. Diesel-elec. switch.	Baldwin Loco.
Southern Pacific	3[5]	6,000-hp. Diesel-elec. pass.	American Loco.
	6[5]	4,000-hp. Diesel-elec. pass.	American Loco.

Locomotive Inquiries

Road	No. of locos.	Type of loco.	Builder
Southern Pacific	30[5]	6,000-hp. Diesel-elec. frt.	
	65	600 to 1,500-hp. Diesel-elec. switch.	

Freight-Car Orders

Road	No. of cars	Type of car	Builder
Erie	11[6]	125-ton flat	Co. shops
St. Louis-San Francisco	130[7]	10,000-gal. tank	American Car & Fdry.
Western Maryland	1,000[8]	55-ton hopper	Bethlehem Steel

Freight-Car Inquiries

Road	No. of cars	Type of car	Builder
Chicago & North Western	15 or 25	70-ton covered hoppers	
Clinchfield	50	50-ton hoppers	
Gulf, Mobile & Ohio	500	50-ton hoppers	
	500	50-ton gondola	
Norfolk & Western	1,000	70-ton hopper	
Western Maryland	200	50-ton gondola	
	200	50-ton box	
	50	50-ton auto box	
	50	70-ton gondola	

Passenger-Car Orders

Road	No. of cars	Type of car	Builder
Erie	30[9]	Baggage and express	American Car & Fdry.
New York Central	30[10]	Multiple-unit	St. Louis Car

Passenger-Car Inquiries

Road	No. of cars	Type of car	Builder
Southern Pacific	5[5]	Baggage-mail	
	5[5]	Dormitory	
	20[5]	Chair	
	5[5]	Coffee-shop-lounge	
	5[5]	Dining	
	5[5]	Lounge	
	30[5]	Sleeping	
	1	Dining	
	1	Lounge	
	1	Baggage-mail	

[1] Deliveries are scheduled to begin next July and to be completed early in 1949.

[2] Delivery scheduled foı early fall.

[3] Delivery accepted.

[4] Delivery scheduled for September. Estimated cost $163,000.

[5] For five new Diesel-powered "Sunset Limited" trains for use in daily service between New Orleans, La., and Los Angeles, Calif. Approximate cost, $15,000,000. Delivery expected late next year. Plans call for the new trains to have an approximate 42-hour schedule between terminals, speediest in the history of the route and about seven hours faster than present running times. Fifteen of the 1,500-hp. locomotives for which the Southern Pacific is inquiring will be road switchers.

[6] Six of the cars will be of the depressed-well type with a height-above-track of 2 ft. The other five will be standard flat cars, 50-ft. long with 6-wheel trucks. Construction is scheduled to begin about June 1.

[7] Delivery scheduled for third quarter of 1949.

[8] Delivery scheduled to begin in February, 1949.

[9] Approximate cost $1,200,000. Delivery scheduled for fall of 1949.

[10] Approximate cost, $3,000,000. Delivery of the equipment is scheduled for late next year. The new 85-ft., 130-passenger cars, to be used in Westchester county, N. Y., commuter service, will be constructed of low-alloy, high-tensile steel and furnished with automatic temperature controls, fluorescent lights, tight-lock couplers and twin-cushion draft gears.

Notes:

Great Northern.—The board of directors of the Great Northern has authorized the purchase and construction of new passenger and freight equipment to cost in excess of $13,000,000. Thirty coaches and sleeping cars will be included in the purchases of passenger equipment, and, as soon as materials are available, the road plans to begin the construction of 500 all-steel, 50-ton box cars in its shops at Superior, Wis., and St. Cloud, Minn.

Illinois Central.—The Illinois Central next year will order 1,975 freight cars from contract builders and 3,000 freight cars from its own shops, it has been announced by Wayne A. Johnston, president. Included in the new equipment, to cost more than $20,000,000, will be 1,500 hopper cars, 100 covered hopper cars and 375 flat cars, all to be ordered from contract builders, and 3,000 hopper cars to be built in the Centralia, Ill., shops.

13.1 per cent. In 1946, the industry consumed 23 million net tons of purchase scrap, of which 13.8 per cent came from the railroads. As a result of Railroad Scrap Collection Week which took place April 5-10 this year, more than 286,000 net tons of scrap either were collected by the railroads or will be made available as a direct result of the drive, according to reports received by the A.A.R. Because of weather conditions and other factors which forced certain railroads in the extreme Northern sections to delay their scrap drive, this figure is expected to be increased when final reports have been received.

C. L. Heater Receives Steel Founders' Medal

CHARLES L. HEATER, vice-president and a director of the American Steel Foundries, at Chicago, was recently awarded the technical and operating medal of the Steel Founders' Society of America, at the organization's annual meeting held in Chicago. Mr. Heater was honored for his contributions to the technical and operating work of the society.

Osborn of Electric-Motive Receives Honorary Degree

AN HONORARY degree of Doctor of Science was awarded to C. R. Osborn, vice-president of the General Motors Corporation and general manager of its Electro-Motive Division, at the June 4 commencement of the University of Cincinnati. Mr. Osborn was graduated by the university in 1921 with a degree in mechanical engineering.

Railroad Club Financing Prizes for Railroad Essays

THE executive committee of the New York Railroad Club, at its meeting on April 15, authorized the expenditure of funds to finance a prize competition for the best papers relating to the improvement and efficiency of railroad administration and operation.

The competition is open to men not more than 35 years of age, whether they are in or out of the railroad field, and regardless of membership in the club. A first prize of $750 will be paid for the best article, $500 for the next best, and $250 as the third prize. The articles must be in the office of the executive secretary of the New York Railroad Club, 30 Church street, New York, on or before February 1, 1949.

They will be judged on the basis of originality of material, constructiveness of thought and adequacy of presentation. They should contain not less than 2,500 words and may be as much longer as necessary to cover the subject properly. They may be accompanied by drawings or photographs to make the meaning clearer.

The only limitation is that the subject discussed must concern railroading and be constructive. The following topics are suggested, but the contestants are not restricted to them:

Opportunities for the railroads to improve their public relations.

Opportunities for the railroads to improve their employee relations.

How to achieve a more economical yard operation.

What should be done to improve freight station operations.

Importance of improving man-hour productivity on track maintenance.

Improvements in freight-car design which will better availability and reduce maintenance.

Improvements in railroad motive power which will better availability and reduce maintenance.

Suggestions for the better utilization of motive power or equipment.

Operating economy by modern signal and communication methods.

While not specifically mentioned in the above suggestions, subjects such as safety, selection and training of employees, traffic and accounting practices, and other factors concerned with railroading will, of course, be acceptable.

Additional information will be furnished by David W. Pye, executive secretary, New York Railroad Club, 30 Church street, New York 7, N.Y.

A. A. R. To Study Passenger-Car Riding

A joint investigation of the riding qualities of passenger cars will be made this summer by the research offices of the Engineering and Mechanical Divisions of the A.A.R. The program as planned covers a series of road tests which will be made on the Philadelphia Division of the Pennsylvania using two car sets of wheels of known eccentricity and unbalance but representing the as-rolled condition which may be expected from the wheel manufacturers. In order that the wheels used will represent the worst 25 per cent to be expected, balance and concentricity checks are being conducted on about 50 pairs of mounted wheels. The test pairs will be chosen from this group. During the road tests the wheels will be progressively balanced and machined so that the effects of such treatment may be observed on the riding qualities of the car under observation.

The program also will include a comparison of coned-tread and cylindrical tread wheels both in new and worn condition, and a study of the effect of track gauge on riding qualities. For the latter investigation a length of track has been prepared by the Pennsylvania which includes test sections that have been narrowed from standard gauge. Test runs will be made up to 100 m.p.h.

The experimental car of the Budd Company will be used throughout the tests. This is a passenger car of modern design which is equipped with electrical and mechanical instruments for the recording of shocks and oscillation of the trucks and body. It will be operated in a special train so that test conditions may be closely controlled, and will be manned by personnel of the A.A.R. research offices as well as by Budd technicians.

The entire program is under the sponsorship of the Joint Committee on Relation Between Track and Equipment, A.A.R.

Supply Manufacturers Plan Exhibits at Railroad Fair

TWENTY-ONE railroad supply firms have thus far announced plans to portray their respective contributions to the railroad industry by means of individual exhibits at the forthcoming Railroad Fair at Chicago, July 20 to September 6, inclusive. In addition to supply exhibits and those of 23 large railroads, displays have been contracted for by the Pullman Company, the Railway Express Agency, the Railroad Retirement Board and the National Safety Council.

The 21 aforementioned companies are: the Electric-Motive Division of General Motors Corporation; Pullman-Standard Car Manufacturing Company; the Budd Company; American Steel Foundries; Association of Manufacturers of Chilled Car Wheels; American Refrigerator Transit Company; Clark Equipment Company; Dieselite Engineering Company; Fafnir Bearing Company; General Electric Company; General Steel Castings Corporation; Great Lakes Steel Corporation; Heywood-Wakefield Company; Haffner-Thrall Car Company; Hertz Drive-Ur-Self System; Illinois Bell Telephone Company; Mars Signal Light Company; the Pyle-National Company; Timken Roller Bearing Company; Union Switch & Signal Co. and the Unit Crane & Shovel Corp.

Miscellaneous Publications

APPRENTICESHIP REVITALIZED. — By Edward E. Goshen, assistant director, Bureau of Apprenticeship, and National Consultant on Apprenticeship in the Railroad Industry. Distributed by the Publications Branch of the Bureau of Apprenticeship, U. S. Department of Labor, Washington, D.C. Eight-page reprint from *Railway Age* describes apprenticeship programs now being established throughout the railroad industry to develop skilled mechanics, as exemplified by the programs of the New York Central and the Union Pacific. Discusses the functions of the General Management-Labor Apprenticeship Committee and of local committees, the work schedule in which apprentices are trained in the shops, the classroom instruction, the types and number of apprentices employed, selection and tests of apprentices, apprenticeship agreements, and certificates of completion. Includes also statements of officers of the New York Central and the Union Pacific appraising the apprenticeship systems.

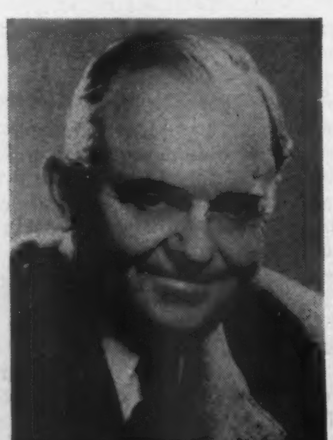
Supply Trade Notes

SHEFFIELD STEEL CORPORATION.—*George P. Lacy* has been appointed manager of railroad sales of the Sheffield Steel Corporation, with headquarters at Kansas City, Mo., *George P. McCracken*, who has served under Mr. Lacy for

G. P. Lacy

the past three years, has been appointed district manager of the San Antonio, Tex., office, succeeding Mr. Lacy. *Ernest Baxter*, vice-president, has retired after more than 30 years of continuous service but will continue to serve in a consulting capacity.

George P. Lacy has been associated with Sheffield for twelve years. He served in various clerical capacities before his first sales assignment, which was in the Missouri territory, and later was in charge of the Little Rock, Ark.,



E. Baxter

and Dallas, Tex., offices, successively. He was then appointed district manager of the San Antonio office, which position he held at the time of his recent appointment.

Ernest Baxter began his career in 1903 as a railroad messenger at London, Ont., and spent the next 15 years in various clerical and official capacities in the operating and executive departments of railroads in Canada and the United States. He resigned as a railroad officer to join Sheffield Steel in 1918 as manager of railroad sales. Successively, he served as general manager sales, assistant to president, and vice-president.

◆

HYDRAULIC PRESS MANUFACTURING COMPANY.—*Howard M. Hubbard* has been elected president of the Hydraulic Press Manufacturing Company, succeeding *H. A. Toulmin, Jr.*, resigned.

◆

UNION RAILWAY EQUIPMENT COMPANY.—*Victor G. Curry*, vice-president in charge of sales in Canada for the Union Railway Equipment Company, has retired because of ill health. *Wayne K. Davidson* has been appointed exclusive sales representative in Canada for the company.

◆

JOHNS-MANVILLE CORPORATION.—*George R. Frankland*, formerly assistant district manager, industrial products division of the Johns-Manville Corporation, has been appointed manager of that division, at Chicago, to succeed *Corydon H. Hall*, resigned. *William S. Hough*, formerly manager of the chemical and aviation sections of the special industries department at New York, has been appointed assistant district manager of the industrial products division.

◆

THOMAS A. EDISON, INC.—*William J. Savage*, formerly eastern sales manager of the primary battery division of Thomas A. Edison, Inc., has been appointed director of sales for the division, with headquarters as before at Bloomfield, N. J.

◆

R. H. SHEPPARD COMPANY.—*Spencer A. Ware* formerly sales manager of the original equipment division of the Farm Corporation, has joined the R. H. Sheppard Company, Hanover, Pa., as general sales manager.

◆

FEDERATED METALS.—*Raymond A. Quadt*, formerly in charge of aluminum research operations for Federated Metals, a subsidiary of the American Smelting & Refining Co., has been appointed assistant manager of Federated's general aluminum department.

◆

MAGNUS BRASS MANUFACTURING COMPANY; NATIONAL LEAD COMPANY.—*John F. Deems* has been elected a director and a vice-president of the Magnus Brass Manufacturing Company and has been appointed manager of the Magnus brass division of the *National Lead Company*.

◆

SKF INDUSTRIES, INC.—*M. H. Courtenay* has been appointed Atlanta (Ga.) district manager of SKF Industries, Inc., to succeed *Nils Miller*, retired.

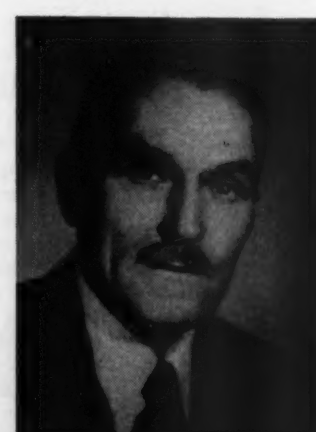
NATIONAL MALLEABLE & STEEL CASTINGS CO.—*Raymond E. Valentine* has been appointed district sales manager at the St. Louis, Mo., office of the National Malleable & Steel Castings Co., to succeed *John H. Jaschka*, who has retired

R. E. Valentine

after 47 years' service. *Howard Stark*, formerly field engineer at the Chicago office, has been appointed assistant district sales manager at St. Louis.

Raymond E. Valentine joined National Malleable in 1913. During World War II, he was chief of the malleable iron section, forgings and castings branch, of the War Production Board. He returned to the company in 1945 as assistant district sales manager at the St. Louis office.

Howard Stark joined the company in 1920 at Cleveland, Ohio. He was later



H. Stark

appointed chief inspector and served successively at the Toledo, Ohio, works and at the Chicago plant. He became field engineer at the Chicago district sales office in 1945.

◆

AMERICAN WELDING & MANUFACTURING CO.—*Robert Watson* has been appointed representative of the railway equipment division of the American

Welding & Manufacturing Co., with headquarters in Chicago. *Robert Watson* served an apprenticeship in locomotive construction and design at Kilmarnock, Scotland, in which country he was born. He came to the United States in 1923 and joined the Ingersoll-Rand Company as a machinist and, shortly thereafter, worked as a draftsman for the American Locomotive Company. In 1925 he joined the Erie as chief draftsman in Cleveland, Ohio. In 1929 he became mechanical and sales engineer for the Firebar Corporation and in 1932 was appointed sales engineer and western sales manager for the Waugh Equipment Company. From 1938 to 1941 he was mechanical and sales engineer for Manning, Maxwell & Moore. In the latter year he returned to Waugh Equipment as assistant to the president and vice-president.

◆

JOSEPH T. RYERSON & SON.—*W. E. Falberg,* formerly in charge of special steel sales for Joseph T. Ryerson & Son at the Cleveland, Ohio, plant, has been appointed manager of alloy and stainless sales at the Chicago plants. *E. H. Bodenmann,* formerly a sales representative of the stainless-steel department at Chicago, has been transferred to Cleveland to succeed Mr. Falberg.

◆

INTERNATIONAL NICKLE COMPANY.—*John W. Crossett* has joined the development and research division of the International Nickel Company, at New York, to succeed the late *Frederick P. Huston.*

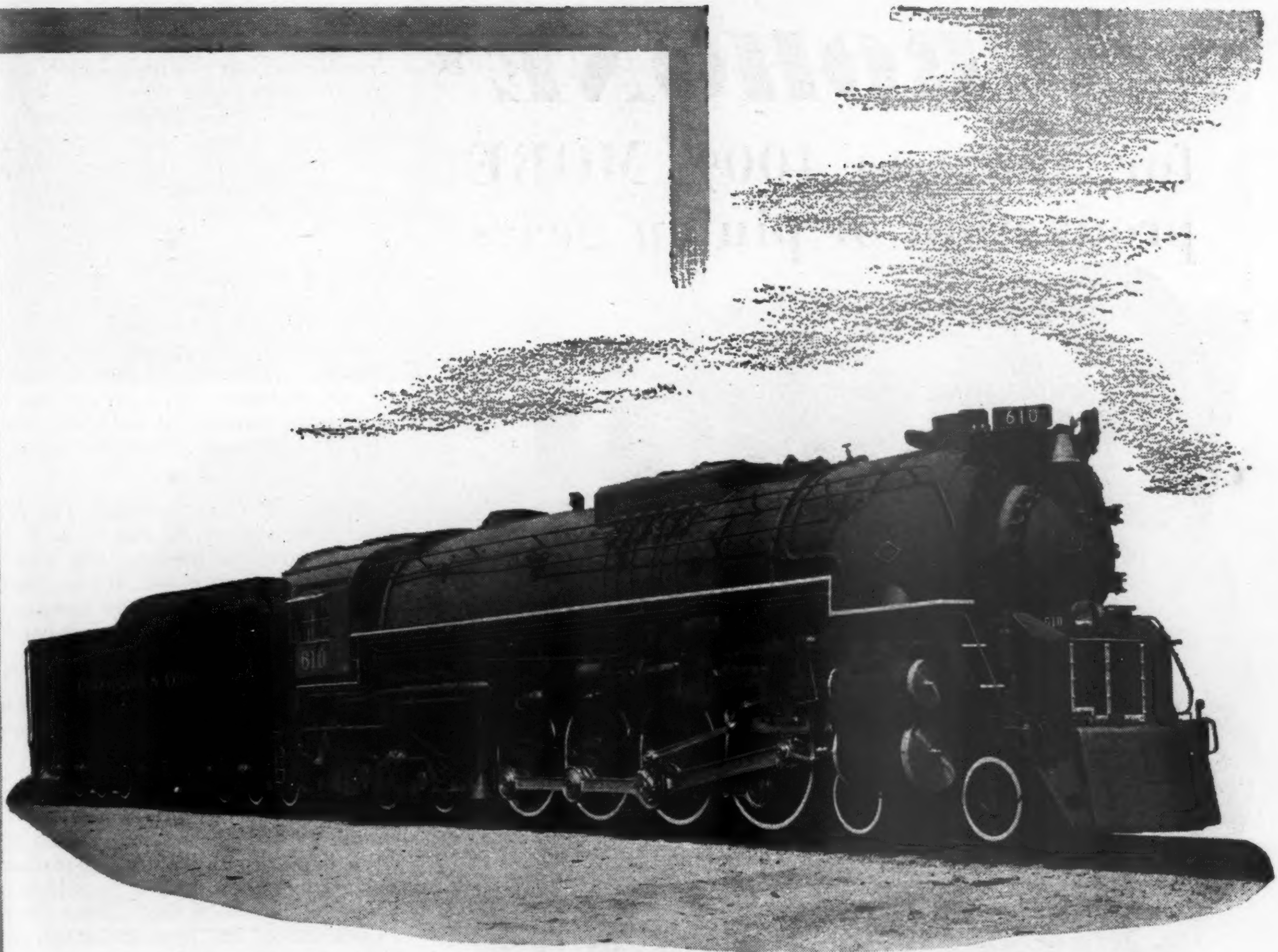
Mr. Crossett, who for the last 11 years has been associated with the Chicago, Milwaukee, St. Paul & Pacific, will follow railroad development work in his new position. He joined the Milwaukee

J. W. Crossett

in 1937 as an assistant metallurgist in the test department and subsequently was appointed chief metallurgist and assistant engineer of tests.

◆

KOPPERS COMPANY. — *Lenvik Ylvisaker,* formerly assistant production manager of the Koppers Company, at Pittsburgh, Pa., has been appointed assistant general manager of the piston ring division, with headquarters at Baltimore,



C & O's NEW 4-8-4's

Class J-3 A
Service: Passenger
Road Nos.: 610-614
Tractive Force, with Booster: 81,800 lb
Cylinders: 27½" x 30"
Drivers, Diameter: 72"*
Weight on Drivers: 282,400 lb
Weight on Front Truck: 81,600 lb
Weight on Trailing Truck: 115,400 lb
Total Weight of Engine: 479,400 lb
Fuel: Soft Coal
Grate Area: 100 sq ft
Steam Pressure: 255 lb
Tender Capacity: 21,500 gal
25 tons

**Can take 74" drivers.*

by

LIMA HAMILTON CORPORATION

DIVISIONS: *Lima, Ohio* — Lima Locomotive Works Division; Lima Shovel and Crane Division. *Hamilton, Ohio* — Hooven, Owens, Rentschler Co.; Niles Tool Works Co.

PRINCIPAL PRODUCTS: Locomotives; Cranes and shovels; Niles heavy machine tools; Hamilton diesel and steam engines; Hamilton heavy metal stamping presses; Hamilton-Kruse automatic can-making machinery; Special heavy machinery; Heavy iron castings; Weldments.

Md., *T. C. Jarrett,* chief metallurgist of the division since 1941, has been appointed manager of the engineering and development department of the division. *John H. Redmond,* formerly vice-president and general manager of Precisioneering, Inc., has been appointed assistant production manager, succeeding Mr. Ylvisaker.

◆

GRAYBAR ELECTRIC COMPANY.—*C. C. McGraw,* formerly manager for the Graybar Electric Company at Savannah, Ga., has been appointed manager at Knoxville, Tenn., to succeed the late F. O. Andridge. *R. L. Wear* has been appointed manager at Savannah and *A. W. Wheeler,* manager at Shreveport, La.

◆

WHITING CORPORATION.—The *Whiting Corporation* of Harvey, Ill., has taken over the business and plant of *Spencer & Morris, Inc.,* at Los Angeles, Cal., and will continue the manufacture of the tramrail-type materials-handling systems which the latter company has distributed during the past 25 years. The plant will operate as the Spencer-Morris Division of the Whiting Corporation.

◆

MORTON - GREGORY CORPORATION. — *Fred J. Meyer,* formerly manager of the railroad division of the Nelson Stud Welding Corporation, the manufacturing assets and patent interests of which have been purchased by the Morton-Gregory Corporation, has been appointed assistant to the Morton-Gregory general sales manager, *R. C. Friedly,* former construction industry specialist on the Nelson staff, has been appointed assistant general sales manager, and *R. J. Kilmer,* assistant general sales manager for Nelson since 1946, has been appointed controller.

F. J. Meyer

◆

HARNISCHFEGER CORPORATION.—The Harnischfeger Corporation, at Milwaukee, Wis., has established a new division to serve railroads exclusively, under the jurisdiction of *George A. Schmus,* the firm's general traffic manager. The railroad division will supply counsel and assistance in the field covered by P. & H. products, which include overhead elec-

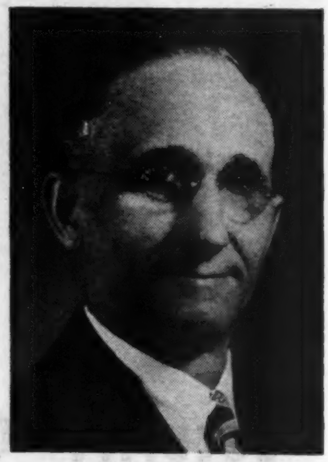
tric traveling cranes, electric hoists, crawler cranes, electric welders and welding electrodes.

◆

WHITCOMB LOCOMOTIVE CO.—*H. V. Huleguard,* vice-president and general manager of the Whitcomb Locomotive Company, a subsidiary of the Baldwin Locomotive Works, has resigned.

◆

GENERAL STEEL CASTINGS CORPORATIONS.—*Harry E. Thiele* has been elected vice-president—manufacturing of the General Steel Castings Corporation, in charge of the manufacturing departments of the company's two plants at Granite City, Ill., and Eddystone, Pa.,



H. E. Thiele

with headquarters at Granite City. Mr. Thiele has worked for more than 35 years in supervisory capacities in the various production departments of the Commonwealth plant.

◆

LINK-BELT COMPANY.—The Link-Belt Company has opened a district sales office in Albany, N. Y., with *J. Charles Bullock,* formerly district sales manager at Schenectady, N. Y., in charge. The company's Schenectady office has been discontinued.

◆

GENERAL ELECTRIC COMPANY.—*Earl O. Shreve,* vice-president of the General Electric Company on the president's staff, and president of the U. S. Chamber of Commerce, has retired from the company after 44 years of service.

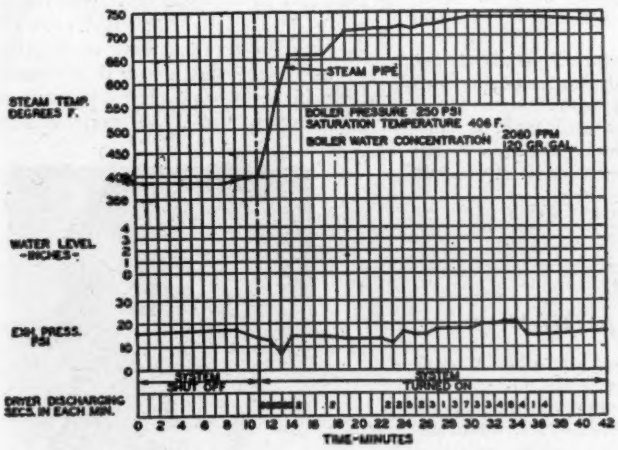
◆

VAPOR HEATING CORPORATION.—*Wirt Farley, Jr.,* formerly on the sales staff of the Vapor Heating Corporation, with headquarters at Chicago, has been appointed manager of the company's office in San Francisco, Calif. *A. P. Stikkers,* formerly of the San Francisco office, has been appointed district engineer at Los Angeles, Calif.

◆

AMERICAN CAR & FOUNDRY CO.—*William C. Roederer,* assistant district manager of the St. Charles, Mo., passenger car plant of the *American Car & Foundry Co.,* has been appointed district manager, to succeed *John W. Lawler* who

A Fuel Saver—
the Elesco Steam Dryer System



TEST OF STEAM DRYER WITH DISCHARGE TO ATMOSPHERE

The steam consumption per i.hp-hr. obtained on a test with a modern high-speed freight locomotive, operating at 50% cutoff, showed the following results:

STEAM TEMPERATURE	STEAM PER I. HP-HR.	SAVINGS from the Use of Superheat
Saturated Steam	28 lb.	—
150 deg. Superheat	21 lb.	25.0%
200 " "	18 lb.	35.6%
250 " "	16 lb.	43.0%
350 " "	14 lb.	50.0%

Foaming is the major cause for carryover in locomotive boilers. Tests were made with bad foaming conditions and you will note from the chart that there was a loss of 300 deg. of superheat due to the intensity of this condition, with dryer shut off.

When the Elesco Steam Dryer System was in operation, the carryover was discharged and the steam temperature increased 300 deg.

The economy of superheat is indicated in the tabulation and it is apparent that the loss of 300 deg. of superheat increased fuel consumption by more than 25%.

With high fuel costs, take steps to stop fuel losses incident to carryover, by eliminating this condition. This can be most effectively accomplished with the **Elesco Steam Dryer System** — INVESTIGATE!

ELESCO

THE
SUPERHEATER
COMPANY

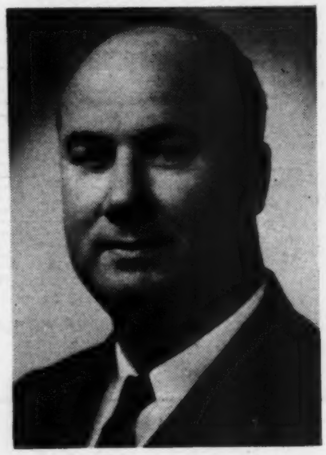
Representative of AMERICAN THROTTLE COMPANY, INC.
60 East 42nd Street, NEW YORK
122 S. Michigan Ave., CHICAGO
Montreal, Canada, THE SUPERHEATER COMPANY, LTD.

A-1909

Superheaters • Superheater Pyrometers • Exhaust Steam Injectors • Steam Dryers • Feedwater Heaters • Steam Generators • Oil Separators • American Throttles

has retired after 50 years' service. *James L. Mahon*, district manager of its Detroit, Mich., plant, who also has been associated with the company and its predecessors for almost 50 years, has retired. *H. F. Schwarting*, formerly general electrical engineer at St. Louis, Mo., has been appointed assist district manager of the Madison (Ill.) plant. *Ralph F. Koeneman* has been appointed assistant chief engineer of the passenger-car division of American Car & Foundry at Berwick, Pa.

William C. Roederer joined the engineering department of American Car & Foundry at the Jeffersonville, Ind., plant in 1910. In 1917 he was transferred to the shops to serve in various departments as assistant and general foreman. In 1925 he was appointed assistant to superintendent; in 1930, general superintendent of the Jeffersonville plant; in 1939, superintendent of the St. Charles, Mo., passenger car department, and in 1945, assistant district manager.



W. C. Roederer

Ralph F. Koeneman joined American Car & Foundry in 1916 at Madison, Ill. He progressed through various positions in the engineering departments of the St. Louis, Mo., and St. Charles plants and, in 1939, helped organize the ordnance division at Berwick. In 1941 he organized the construction of light combat tanks at St. Charles, and during World War II worked in ordnance en-

R. E. Koeneman

HELP AMERICA PRODUCE FOR PEACE
SCRAP

Years of standout service have proved General Motors Diesel freight locomotives can continuously haul heavier tonnages over greater distances, economically, in quicker time than any other motive power.

On the Burlington lines, 29 General Motors freight locomotives placed in service at various times since January 1944, have been available for work 506,403 hours out of a total of 581,031 for an availability average of 87.2% and the Burlington's fleet of General Motors switchers, the first of which went into service in 1937, has an average availability of 94.7% of total hours.

Yes, indeed, the freight goes *through* behind General Motors Diesels with less wear on track; quicker acceleration; faster grade climbing; fewer service stops and lower fuel cost — all of which mean greater economies, efficiencies and profit in railroading.

GENERAL MOTORS
LOCOMOTIVES

ELECTRO-MOTIVE DIVISION

GENERAL MOTORS LA GRANGE, ILL.

Home of the Diesel Locomotive

gineering and development. In February, 1946, he returned to the design of railroad passenger cars in the passenger car engineering office at New York.

◆

MAGNUS METAL CORPORATION.—*Charles C. Rieth* has been appointed eastern sales manager of the Magnus Metal Corporation.

◆

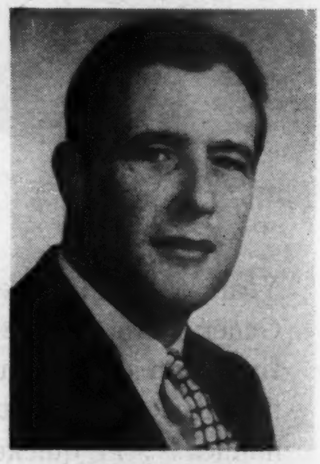
ROBERT H. WELLINGTON has been appointed sales representative of the Griffin Wheel Company, with headquarters at Boston, Mass.

◆

CARDWELL-WESTINGHOUSE COMPANY; UNIVERSAL RAILWAY DEVICES COMPANY.—*Paul D. Curtis* has been appointed resident representative of the Cardwell-Westinghouse Company and the Universal Railway Devices Company, at St. Paul, Minn., with offices in the First National Bank building in that city.

◆

DEARBORN RAILWAY SPECIALTY COMPANY.—The Dearborn Railway Specialty Company, Dearborn, Mich., has announced the appointment of the *Casey-Newhall Corporation*, San Francisco, Calif., as exclusive distributor of its wheel grinding brake shoes in the Pacific coast states. The Casey-Newhall Corporation, organized by *Alexander M.*



A. M. Casey

Casey, its president, and *Walter S. Newhall* shortly after they were released from active service in the Navy, acts as Pacific coast representative of eastern manufacturers handling equipment lines for railroads and industrial establishments.

◆

DEARBORN CHEMICAL COMPANY.—*Charles S. Silsbee*, formerly manager of the Dearborn Chemical Company's marine division, with headquarters at New York, has been transferred to Chicago as assistant to vice-president of the industrial feedwater sales and engineering department.

◆

PULLMAN-STANDARD CAR MANUFACTURING COMPANY.—*George A. Huggins*, formerly manager of the Santa Monica (Calif.) plant of the Douglas Aircraft

Railway Executives:

take a new look at car floor maintenance costs

You will find it worth your while to break down car maintenance costs and determine how much you spend for floor repairs and replacement. It will probably run to a big figure. Damage to conventional floors from rough freight, nailing, decay, and materials-handling equipment is taking place every day, on every road.

now something can be done about it

Bloom Croppings—Magnet Loaded—This kind of freight dishes conventional steel-plate floors out of shape, and shouldn't be loaded at all in wood floor cars. NAILABLE STEEL FLOORING stays generally flat and nailable under impact loading.

The answer:

*NAILABLE STEEL FLOORING

You can now take a big cut out of floor repairs—and *virtually eliminate floor replacements*—by standardizing on NAILABLE STEEL FLOORING in box cars, flats and gondolas. This tougher, all-purpose flooring is built to last as long as the car, and here's why:

High Structural Strength—NAILABLE STEEL FLOORING in boxcars will not fail under fork trucks; in gondolas, there are no break-throughs from impact loading.

No Damage From Nailing—Nails really hold in NAILABLE STEEL FLOORING (tighter than in wood) yet they don't damage the floor in any way.

High Wear-Resistance—Abrasive wear from rough freight and loading equipment that destroys wood floors is negligible in NAILABLE STEEL FLOORING.

No Torn Up Plates—With no rivet heads or plate edges, NAILABLE STEEL FLOORING can't be ripped up during clamshell unloading of bulk freight.

Break down your car maintenance costs—and find out *how much* NAILABLE STEEL FLOORING can save in floor repair and replacement costs.

Fork Trucks—Efficient loading demands them, but they're tough on wood floors. NAILABLE STEEL FLOORING safely takes the heaviest boxcar loading equipment.

*PATENTS PENDING

NAILABLE STEEL FLOORING

A GREAT LAKES STEEL PRODUCT

GREAT LAKES STEEL CORPORATION

STEEL FLOOR DIVISION, PENOBSCOT BLDG., DETROIT 26, MICHIGAN

UNIT OF NATIONAL STEEL CORPORATION

Corporation, has joined the Pullman-Standard Car Manufacturing Company as general manager of its car works in Chicago.

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McConway & Torley Corp.—*Paul Y. Duffee* has been appointed chief engineer and *Graham J. Logan*, assistant superintendent of the McConway & Torley Corp.

Obituary

Joseph Warren Young, retired eastern railway sales manager of the Kerite Insulated Wire & Cable Co., died at his home in Jersey City, N. J., on May 16. Mr. Young was born on November 3, 1876. He began his railroad career with the Delaware, Lackawanna & Western in 1896 and until 1912 was, at various times, associated with the Central of New Jersey, the New York Susquehanna & Western and the Erie. He was assistant signal engineer of the Erie at the time he joined the Kerite staff in 1912. He retired on December 1, 1946.

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James J. Hughes, sales agent in Chicago for the Ohio Steel Foundry Company for the past 26 years, died in that city on May 18, after a short illness. Mr. Hughes was formerly associated with the Chicago, Rock Island & Pacific, the Delaware, Lackawanna & Western and American Steel Foundries. He was 67 years old.

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Walter Lewis Conwell, president of the Safety Car Heating & Lighting Co. since 1919, died at his home in Montclair, N.J., on May 27. He was 71 years old.

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Thomas H. Henkle, retired western sales manager and special representative of the Edward G. Budd Manufacturing Company (now the Budd Company), at Chicago, died at his home in California on May 21, following a long illness. Mr. Henkle, who was considered one of the pioneers in the development of streamline train equipment, retired in 1945.

Personal Mention

General

Cecil Asa White, master mechanic of the Atlantic Coast Line at Rocky Mount, N.C., has been appointed superintendent of motive power of the Western division of the Atlantic Coast Line at Fitzgerald, Ga.

Mr. White was born at Montgomery, Ala., on March 12, 1889. He is a graduate of International Correspondence School in mechanical engineering. He entered the service of the A.C.L., as an apprentice machinist at Montgomery on September 6, 1904. He became machinist in November, 1909; erecting shop foreman in October, 1910; enginehouse

foreman in July, 1914; general foreman at Charleston, S. C., in February, 1920; master mechanic at Waycross, Ga., in March, 1921, and shop superintendent in November, 1923. His title was changed to master mechanic in June, 1933. Mr. White entered military service in the 703rd Railway Grand Division on August 1, 1942. He served in North Africa, and came out of the service as a lieutenant colonel. He was appointed acting master mechanic of the Atlantic Coast Line at Florence, S. C., on March 14, 1945, and master mechanic at Rocky Mount, N. C., on July 1, 1945.

W. B. Berry, whose appointment to the newly-created position of chief mechanical officer of the St. Louis-San Francisco, at Springfield, Mo., was reported in the June issue, was born at St. Louis, Mo., on December 13, 1881. He entered railway service on January 1, 1897, as a machinist apprentice in the employ of the Texas & Pacific at Marshall, Tex. During the next few years he served as machinist on the T. & P., and then went with the Missouri Pacific, subsequently serving the Chicago, Rock Island & Pacific, the Missouri-Kansas-Texas, the Southern Pacific, the Trinity & Brazos Valley, and the Atchison, Topeka & Santa Fe, in capacities ranging from machinist to enginehouse foreman and general foreman. In May, 1922, Mr. Berry became master mechanic of the Frisco at Kansas City, Mo., on August 10, 1935, assistant superintendent of motive power at Springfield, and in October, 1945, superintendent of motive power.

W. B. Berry

C. D. Young, vice-president in charge of purchases, stores and insurance of the system at Philadelphia, Pa., retired on June 1. Mr. Young was born at Washington, D. C. He is a graduate of Cornell University. In 1902 he started as a special apprentice in the employ of the Pennsylvania. He advanced through the mechanical engineering grades to engineer of tests at Altoona, Pa., in 1911, and to superintendent of motive power of the Southern General division in 1917. Mr. Young became supervisor of stores in 1920 and was subsequently stores manager, general purchasing agent and as-

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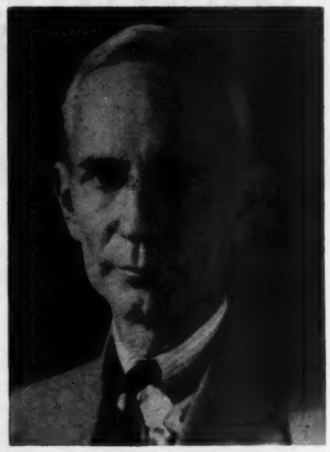
sistant vice-president in charge of purchases, stores and insurance. He became vice-president in 1932 and in 1938 his responsibilities were enlarged to include the Real Estate department. Mr. Young was elected a director in 1939. Mr. Young is a widely known authority on the technological and metallurgical requirements of the transportation industry. In World War I he served in France as a lieutenant colonel in the Transportation Corps. In World War II he was commissioned a brigadier general and appointed director of the Procurement and Distribution Division, Service of Supply, United States Army. Following his work in that capacity he went on



C. D. Young

inactive status and became assistant director, and afterwards deputy director and acting director, of the Office of Defense Transportation, returning to the P.R.R. on November 1, 1945.

William H. Gimson, whose appointment as superintendent of motive power of the St. Louis-San Francisco at Springfield, Mo., was reported in the June issue, was born at Memphis, Tenn., on September 13, 1887. He entered railway service with the Frisco as a machinist apprentice in September, 1904, at Memphis. Later he served as enginehouse foreman and, on March 1, 1917, was appointed division foreman, with headquarters at Harvard, Ark. In the same year Mr. Gimson became general fore man at Monett, Mo., in August, 1929, shop superintendent at Tulsa, Okla.; master mechanic at Tulsa in 1941, and assistant superintendent of motive power at Springfield in October, 1945.

Andrew J. Ferentz, whose appointment as assistant superintendent motive power-car of the Lehigh Valley at Sayre, Pa., was reported in the June issue, was born at November 7, 1899, at Budapest, Austria-Hungary. He attended high school at Wilkes-Barre, Pa., for one year and then on July 24, 1919, entered railroad service as a car repairman in the employ of the Central of New Jersey at Ashley, Pa. In 1926 he was appointed gang foreman; two years later chief piecework inspector; in 1930, general car foreman; in 1931 assistant general car

foreman, and in November, 1934, foreman car yards at Jersey City, N.J. On January 1, 1942, Mr. Ferentz became superintendent car department of the Lehigh Valley at Sayre. He was appointed assistant superintendent of the Wyoming division of the L. V. at Wilkes-Barre on September 16, 1942; superintendent of that division on April 1, 1943, and superintendent of the Buffalo (N.Y.) division on January 4, 1945.

Charles S. Perry, superintendent of motive power, Western division of the Atlantic Coast Line at Fitzgerald, Ga., retired on March 1. Mr. Perry is a native of Alabama and entered the service of the Atlanta, Birmingham & Coast on November 1, 1921, as a machinist. He subsequently became night enginehouse foreman, general foreman and master mechanic at Fitzgerald, Ga. He was appointed superintendent motive power at Atlanta, Ga., in August, 1938, being transferred to Fitzgerald with the merger of the A.B.&C. and the A.C.L.

W. D. Hartley, mechanical superintendent of the Atchison, Topeka & Santa Fe at Topeka, Kans., has been transferred to La Junta, Colo.

William Henry, road foreman of engines of the Baltimore & Ohio at Cumberland, Md., has been appointed acting supervisor of locomotive operation at Cumberland, Md.

Diesel

C. H. Broadbent has been appointed Diesel locomotive inspector of the New York Central System, with headquarters at St. Thomas, Ont.

Car Department

James F. Crawford, assistant chief clerk of the Atlantic Coast Line at Wilmington, N. C., has been appointed general car inspector at Jacksonville, Fla.

Master Mechanics and Road Foremen

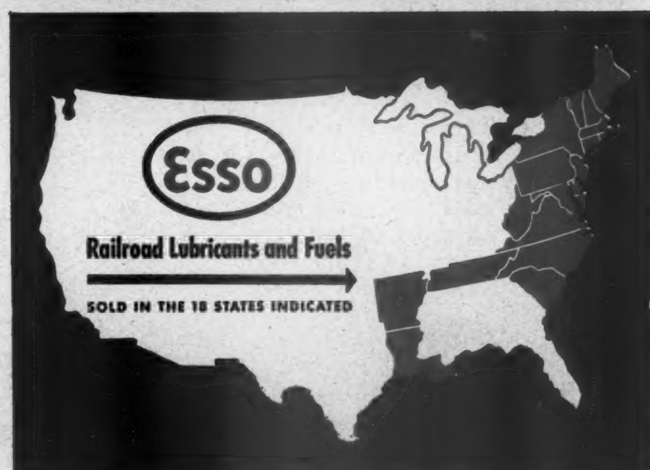
Charles O. Butler, master mechanic of the Atlantic Coast Line at Florence, S.C. ,has been transferred to the position of master mechanic at Rocky Mount, N.C.

B. F. Hotchkiss, instructor in fuel economy of the Baltimore & Ohio at Baltimore, Md., has been appointed assistant road foreman of engines at Cumberland, Md.

Frank D. Sineath, general foreman of the Atlantic Coast Line, has been appointed acting master mechanic of the Columbia and Charleston districts, with headquarters at Florence, S. C.

W. Y. Amig, master mechanic of the Pennsylvania at Indianapolis, Ind., has been transferred to Forest Park, Long Island, N.Y.

E. L. Spicer, general foreman of the Atlantic Coast Line at Waycross, Ga.,



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has been appointed master mechanic of the Waycross district, with headquarters at Waycross.

E. M. Cooney, master mechanic of the Chicago & Eastern Illinois at Danville, Ill., retired on January 15.

Paul Thomas, master mechanic of the Panhandle division of the Pennsylvania, has been transferred to Indianapolis, Ind.

Robert E. Bigelow, system supervisor locomotive operations of the Lehigh Valley at Jersey City, N.J., has been appointed road foreman of engines of the Wyoming division at Wilkes-Barre, Pa.

W. H. Haynes, general foreman of the Chicago & Eastern Illinois, has been appointed master mechanic at Danville, Ill.

I. F. Stephens, road foreman of engines of the Baltimore & Ohio at East Salamanca, N.Y., has been transferred to the position of road foreman of engines at Cumberland, Md.

A. K. Jacobs, assistant road foreman of engines of the Baltimore & Ohio at Willard, Ohio, has been appointed road foreman of engines at East Salamanca, N.Y.

I. C. Kephart, instructor in fuel economy of the Baltimore & Ohio at Baltimore, Md., has been promoted to the position of assistant road foreman of engines at Garrett, Ind.

Electrical

H. W. Wreford, chief inspector train lighting and air conditioning of the Canadian National at Montreal, Que., has been appointed electrical superintendent, St. Clair Tunnel, with headquarters at Port Huron, Mich.

J. C. McElree, electrical engineer of the Missouri Pacific at St. Louis, Mo., has retired after 44 years of railroad service.

L. J. Verbarg, air-conditioning engineer of the Missouri Pacific, at St. Louis, Mo., has been appointed electrical engineer, with headquarters at St. Louis, Mo.

Shop and Enginehouse

R. J. Bush, mechanical inspector and swing foreman of the Chicago & Eastern Illinois at Danville, Ill., has been promoted to the position of general foreman.

Harry A. Bormann has been appointed general foreman of the Chicago & Eastern Illinois at Evansville, Ind.

Raymond Larson, roundhouse foreman of the Northern Pacific at Glendive, Mont., has been appointed master mechanic at Glendive.

A. I. Anderson, master mechanic of the Northern Pacific, with headquarters at Glendive, Mont., has been promoted to the newly created position of assistant shop superintendent at Livingston, Mont.